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Exelon Nuclear

10CFR50.90

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RS-02-028

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Braidwood Station, Units 1 and 2
Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Byron Station, Units 1 and 2
Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

Subject: Request for License Amendment for Technical Specifications - DC Electrical Power Systems

References:

(1) Technical Specifications Task Force (TSTF) Standard Technical Specification (TS) Change Traveler TSTF-360, Revision 1, DC Electrical Rewrite

(2) TSTF Standard TS Change Traveler TSTF-204, Revision 3, Revise DC Sources – Shutdown and Inverters – Shutdown to Address Specific Subsystem Requirements

(3) Letter from J. B. Hopkins (NRC) to O. D. Kingsley (Exelon Generation Company, LLC), "Clinton Power Station, Unit 1 – Issuance of Amendment," dated February 15, 2002

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," we are proposing changes to the Technical Specifications (TS) of Facility Operating License Nos. NPF-72, NPF-77, NPF-37 and NPF-66 for the Braidwood Station, Units 1 and 2 and the Byron Station, Units 1 and 2, respectively. The proposed changes are consistent with Technical Specifications Task Force (TSTF) Standard Technical Specification (TS) Change Traveler TSTF-360, Revision 1 (Reference 1) and TSTF Standard TS Change Traveler TSTF-204, Revision 3 (Reference 2). The proposed changes revise TS 3.8.4, "DC Sources – Operating," TS 3.8.5, "DC Sources – Shutdown," TS 3.8.6, "Battery Cell Parameters," and TS 3.8.8, "Inverters – Shutdown."

A001

The proposed changes associated with TSTF-360, Revision 1, revise TS 3.8.4, TS 3.8.5, and TS 3.8.6 and include the following changes. The proposed changes add new Required Actions and extend the Completion Time for an inoperable battery charger, as well as provide alternate battery charger testing criteria for TS 3.8.4 and TS 3.8.5. The proposed changes also include the relocation to a licensee-controlled program of a number of Surveillance Requirements (SRs) in TS 3.8.4 that perform preventive maintenance on the safety-related batteries. It is proposed that TS Table 3.8.6-1, "Battery Cell Parameters Requirements," be relocated to a licensee-controlled program, and specific Required Actions associated with out-of-limits conditions for battery cell float voltage, float current, electrolyte level, and electrolyte temperature be added to TS 3.8.6. In addition, specific SRs are being proposed for verification of these parameters. In accordance with TSTF-360, Revision 1, a new administrative TS program is being proposed for the maintenance and monitoring of station batteries based on the recommendations of Institute of Electrical and Electronics Engineers (IEEE) Standard 450-1995, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications." All of the items proposed to be relocated will be contained within this new program.

The proposed changes associated with TSTF-204, Revision 3, revise TS 3.8.5 and TS 3.8.8 to require only one DC electrical power subsystem and two inverters, respectively, during shutdown conditions. Each of the four AC instrument buses (i.e., 2 per division) is normally supplied AC electrical power by a dedicated inverter. This option applies to plants having a pre-Improved TS (ITS) licensing basis for electrical power requirements during shutdown conditions that required only one DC electrical power subsystem and two inverters to be operable. The Braidwood and Byron Stations' pre-ITS licensing basis for electrical power requirements during shutdown conditions required only one DC electrical power subsystem and two inverters to be operable.

The changes are being proposed to support performance of periodic on-line battery charger maintenance and post-maintenance testing, thereby reducing plant refueling outage duration and improving battery charger availability during shutdown. The changes will provide operational flexibility by allowing more efficient application of plant resources to safety significant activities. The proposed changes are consistent with the changes previously approved by the NRC for Clinton Power Station as documented in Reference 3.

We request approval of the proposed changes prior to September 8, 2002.

This proposed amendment request is subdivided as follows.

1. Attachment A contains a description and safety analysis of the proposed changes.

2. Attachments B-1 and B-2 include the marked-up TS pages with the proposed changes indicated for Braidwood Station and Byron Station, respectively. Attachments B-3 and B-4 include the associated typed TS Bases pages with the proposed changes incorporated for information only for Braidwood Station and Byron Station, respectively.

3. Attachment C describes our evaluation performed using the criteria in 10 CFR 50.91(a)(1), "Notice for public comment," which provides information supporting a finding of no significant hazards consideration using the standards in 10 CFR 50.92(c), "Issuance of amendment."

4. Attachment D provides information supporting an environmental assessment and a finding that the proposed changes satisfy the criteria for a categorical exclusion.

The proposed changes have been reviewed by the Braidwood Station and the Byron Station Plant Operations Review Committees and approved by the Nuclear Safety Review Boards in accordance with the requirements of the Quality Assurance Program.

Exelon Generation Company, LLC is notifying the State of Illinois of this application for changes to the TS by sending a copy of this letter and its attachments to the designated State Official.

Should you have any questions concerning this letter, please contact Ms. Kelly M. Root at (630) 657-2820.

Respectfully,

K. A. Ainger for

Keith R. Jury
Director - Licensing
Mid-West Regional Operating Group

Affidavit

Attachments:
Attachment A: Description and Safety Analysis of the Proposed Changes
Attachment B-1: Marked-Up TS Page for Proposed Changes for Braidwood Station
Attachment B-2: Marked-Up TS Page for Proposed Changes for Byron Station
Attachment B-3: Incorporated TS Bases Pages for Proposed Changes for Braidwood Station
Attachment B-4: Incorporated TS Bases Pages for Proposed Changes for Byron Station
Attachment C: Information Supporting a Finding of No Significant Hazards Consideration
Attachment D: Information Supporting an Environmental Assessment

cc: Regional Administrator - NRC Region III
NRC Senior Resident Inspector - Braidwood Station
NRC Senior Resident Inspector - Byron Station
Office of Nuclear Facility Safety - Illinois Department of Nuclear Safety

STATE OF ILLINOIS	)	
COUNTY OF DUPAGE	)	
IN THE MATTER OF	)	
EXELON GENERATION CO., LLC	)	**Docket Numbers**
BRAIDWOOD STATION UNITS 1 AND 2	)	**STN 50-456 AND STN 50-457**
BYRON STATION UNITS 1 AND 2	)	**STN 50-454 AND STN 50-455**

SUBJECT: **Request for License Amendment for Technical Specifications - DC Electrical Power Systems**

AFFIDAVIT

I affirm that the content of this submittal is true and correct to the best of my knowledge, information and belief.

K. A. Ainger

K. A. Ainger
Manager - Licensing
Mid-West Regional Operating Group

Subscribed and sworn to before me, a Notary Public in and

for the State above named, this 8 day of

March, 2002.

Anese L. Grigsby
Notary Public

OFFICIAL SEAL
ANESE L. GRIGSBY
NOTARY PUBLIC, STATE OF ILLINOIS
MY COMMISSION EXPIRES 3-13-2005

ATTACHMENT A

DESCRIPTION AND SAFETY ANALYSIS OF THE PROPOSED CHANGES

A. SUMMARY OF PROPOSED CHANGES

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," we are proposing changes to the Technical Specifications (TS) of Facility Operating License Nos. NPF-72, NPF-77, NPF-37 and NPF-66 for the Braidwood Station, Units 1 and 2 and the Byron Station, Units 1 and 2, respectively. The proposed changes are consistent with Technical Specifications Task Force (TSTF) Standard Technical Specification (TS) Change Traveler TSTF-360, Revision 1 (Reference 1) and TSTF Standard TS Change Traveler TSTF-204, Revision 3 (Reference 2). The proposed changes revise TS 3.8.4, "DC Sources – Operating," TS 3.8.5, "DC Sources – Shutdown," TS 3.8.6, "Battery Cell Parameters," and TS 3.8.8, "Inverters – Shutdown."

The proposed changes associated with TSTF-360, Revision 1, revise TS 3.8.4, TS 3.8.5, and TS 3.8.6 and include the following changes. The proposed changes add new Required Actions and extend the Completion Time for an inoperable battery charger, as well as provide alternate battery charger testing criteria for TS 3.8.4 and TS 3.8.5. The proposed changes also include the relocation to a licensee-controlled program of a number of Surveillance Requirements (SRs) in TS 3.8.4 that perform preventive maintenance on the safety-related batteries. It is proposed that TS Table 3.8.6-1, "Battery Cell Parameters Requirements," be relocated to a licensee-controlled program, and specific Required Actions associated with out-of-limits conditions for battery cell float voltage, float current, electrolyte level, and electrolyte temperature be added to TS 3.8.6. In addition, specific SRs are being proposed for verification of these parameters. In accordance with TSTF-360, Revision 1, a new administrative TS program is being proposed for the maintenance and monitoring of station batteries based on the recommendations of Institute of Electrical and Electronics Engineers (IEEE) Standard 450-1995, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications." All of the items proposed to be relocated will be contained within this new program.

The proposed changes associated with TSTF-204, Revision 3, revise TS 3.8.5 and TS 3.8.8 to require only one DC electrical power subsystem and two inverters, respectively, during shutdown conditions. Each of the four AC instrument buses (i.e., 2 per division) is normally supplied AC electrical power by a dedicated inverter. This option applies to plants having a pre-Improved TS (ITS) licensing basis for electrical power requirements during shutdown conditions that required only one DC electrical power subsystem and two inverters to be operable. The Braidwood and Byron Stations' pre-ITS licensing basis for electrical power requirements during shutdown conditions required only one DC electrical power subsystem and two inverters to be operable.

B. DESCRIPTION OF THE CURRENT REQUIREMENTS

TS 3.8.4

The DC electrical power subsystems, with each subsystem consisting of a battery, battery charger, and the corresponding control equipment and interconnecting cabling supplying power to the associated bus within the division, are required to be operable to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an Anticipated Operational Occurrence (AOO) or a postulated Design Basis Accident (DBA). Loss of any division DC electrical power subsystem does not prevent the minimum safety function from being performed. Furthermore, at least one crosstie breaker between Division 11 and Division 21, and at least one crosstie breaker between Division 12 and Division 22, is required to be open to maintain independence between the units.

An operable DC electrical power subsystem requires the required battery and respective charger to be operating and connected to the associated DC bus.

TS 3.8.5

The DC electrical power subsystems are required to be operable to support the required division(s) of the distribution systems required operable by TS 3.8.10. This ensures the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

TS 3.8.5.b allows the option to use a battery, a charger, or the crossties to the opposite unit's associated DC bus to maintain power to the redundant Class 1E DC electrical power distribution subsystem(s) when required by TS 3.8.10. This provision accommodates the required maintenance and/or testing of the shutdown unit's DC electrical power distribution subsystem(s) and continues to maintain the required redundant equipment operable.

TS 3.8.5 is modified by a Note which allows one division to be crosstied to the opposite unit, when the opposite unit is in Mode 1, 2, 3, or 4 with an inoperable charger. No load restrictions are placed on the bus loading, when the one division is crosstied.

TS 3.8.6

Battery cell parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an AOO or a postulated DBA. Electrolyte limits are conservatively established, allowing continued DC electrical system function even with Category A and B limits not met.

TS 3.8.8

The inverters ensure the availability of electrical power for the instrumentation for systems required to shut down the reactor and maintain it in a safe condition after an AOO or a postulated DBA. One AC instrument bus division energized by two battery-powered inverters provides uninterruptible supply of AC electrical power to at least one AC instrument bus division even if the 4.16 kV safety buses are de-energized. Operability of these two inverters requires that the associated AC instrument buses be powered by the inverters. When the redundant division of the Class 1E AC instrument bus electrical power distribution subsystem is required by TS 3.8.10, the power source for the AC instrument buses may consist of:

a. one inverter powered by its associated battery;

b. one inverter powered by its internal AC source; or

c. one Class 1E constant voltage source transformer.

This ensures the availability of sufficient inverter power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

C. BASES FOR THE CURRENT REQUIREMENTS

TS 3.8.4 and TS 3.8.5

The station DC electrical power system provides the AC emergency power system with control power. It also provides both motive and control power to selected safety related equipment and AC instrument bus power (via inverters). As required by 10 CFR 50, Appendix A, GDC 17, "Electric power systems," the DC electrical power system is designed to have sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure. The DC electrical power system also conforms to the recommendations of Regulatory Guide (RG) 1.6, "Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems," March 1971, and Institute of Electrical and Electronics Engineers (IEEE) Standard 308-1978, "Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Station."

The 125 VDC electrical power system for each unit consists of two independent and redundant safety-related Class 1E DC electrical power subsystems (Division 11 (21) and Division 12 (22)). Each subsystem consists of one 125 VDC battery, the associated battery charger for each battery, and all the associated control equipment and interconnecting cabling.

During normal operation, the 125 VDC loads are powered from the battery chargers with the batteries floating on the system. In case of a loss of normal power to the battery charger, the DC load is automatically powered from the station battery.

The Division 11 (21) and Division 12 (22) DC electrical power subsystems provide the control power for its associated Class 1E AC power load group, 4.16 kV switchgear, and 480 V load centers. The DC electrical power subsystems also provide DC electrical power to the inverters, which in turn power the AC instrument buses. Additionally, the Class 1E 125 VDC electrical power subsystems provide power to the 6.9 kV Reactor Coolant Pump (RCP) breakers and the non-Class 1E 125 VDC buses. The connection between the Class 1E and non-Class 1E 125 VDC buses contains fuses to ensure that a fault on the non-Class 1E bus does not cause a loss of the Class 1E bus.

Each battery was sized based upon supplying the design duty cycle in the event of a loss of offsite AC power concurrent with a Loss of Coolant Accident (LOCA) and a single failure of a Diesel Generator (DG). Each battery has a nominal rating of 2320 ampere-hours at the 8 hour discharge rate to an end voltage of 1.75 volts per cell, and was sized in accordance with IEEE-485-1983, "Recommended Practice for Sizing Large Lead Acid Storage Batteries for Generating Stations and Substations."

Each 125 VDC battery is separately housed in a ventilated room apart from its charger and distribution centers. Each subsystem is located in an area separated physically and electrically from the other subsystem to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems, such as batteries, battery chargers, or distribution panels. While it is possible to interconnect the Unit 1 and Unit 2 DC electrical power subsystems, they normally remain disconnected, except when a DC source must be taken out of service for the purposes of maintenance and/or testing, or in the event of a failure of a DC source.

The crosstie between 125 VDC ESF buses 111 and 211 and the crosstie between 125 VDC ESF buses 112 and 212 are each provided with two normally locked open, manually operated circuit breakers. No interlocks are provided since the interconnected buses are not redundant. However, if one battery is inoperable, procedural and administrative controls are used to limit the connected load to 200 amps based on not exceeding the operable battery capacity. These controls ensure that combinations of maintenance and test operations will not preclude the system capabilities to supply power to the ESF DC loads. The provisions of administratively controlled, manually actuated, interconnections between the non-redundant Class 1E DC buses increases the overall reliability and availability of the DC systems for each unit in that it provides a means for manually providing power to a DC bus at a time when it would otherwise have to be out-of-service (e.g., to perform a battery discharge test during an outage, to replace a damaged cell, etc.). Crosstie breaker closed alarms are also provided to alert the operator when the units are crosstied.

Each Division 11 (21) and Division 12 (22) DC electrical power subsystem battery charger has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger also has sufficient capacity to restore the battery from the design minimum charge to its fully charged state within 24 hours while supplying normal steady state loads discussed in the UFSAR Section 8.3.2.1, "D-C Power System, Description."

TS 3.8.6

This TS delineates the limits on electrolyte temperature, level, float voltage, and specific gravity for the DC power source batteries. A discussion of these batteries and their operability requirements is provided in the discussion above for TS 3.8.4 and TS 3.8.5.

TS 3.8.8

The inverters are the preferred source of power for the AC instrument buses because of the stability and reliability they provide. Each of the four AC instrument buses (2 per division) is normally supplied AC electrical power by a dedicated inverter. The inverters can be powered from an AC source/rectifier or from an associated 125 VDC battery. The battery provides an uninterruptible power source for the instrumentation and controls for the Reactor Protection System (RPS) and the Engineered Safety Features Actuation System (ESFAS). Specific details on inverters and their operating characteristics are found in the UFSAR Chapter 8, "Electric Power."

D. NEED FOR REVISION OF THE REQUIREMENTS

Implementation of the proposed changes would provide the following benefits.

- Allow increased flexibility in the scheduling and performance of preventive maintenance.

- Allow better control and allocation of resources. Allowing on-line preventive maintenance provides the flexibility to focus resources on any required or elected battery charger maintenance.
- Avert unplanned plant shutdowns and minimize requests for a Notice of Enforcement Discretion (NOED). Risks incurred by unexpected plant shutdowns can be comparable to and often exceed those associated with continued power operation.
- Support performance of periodic on-line battery charger maintenance and post-maintenance testing, thereby reducing plant refueling outage duration and improving battery charger availability during shutdown. This will minimize the need to perform battery charger maintenance coincident with the various other activities and equipment outages that occur during a refueling outage.

The proposed Completion Time of seven days is adequate to perform required periodic maintenance, preventive maintenance, and post-maintenance testing, in addition to providing sufficient time to address emergent failures of varying degrees.

The proposed changes are consistent with the changes previously approved by the NRC for Clinton Power Station as documented in Reference 4.

E. DESCRIPTION OF THE PROPOSED CHANGES

TS 3.8.4, TS 3.8.5, TS 3.8.6, TS 3.8.8, and TS Section 5.5 are revised to:

(1) Provide an increased Completion Time for an inoperable battery charger.
(2) Relocate preventive maintenance SRs to licensee-controlled program.
(3) Provide alternate testing criteria for battery charger testing.
(4) Replace battery specific gravity monitoring with float current monitoring.
(5.1) Relocate to a licensee-controlled program based on IEEE-450 and/or the TS Bases:
  (a) Category A and B limits for battery cell float voltage and electrolyte level, along with the associated compensatory actions;
  (b) Category C specific value limit for electrolyte level;
  (c) The specific value limit for electrolyte temperature; and
  (d) Specific value for the minimum battery charging float voltage.
(5.2) Create a TS 5.0 Administrative Controls program to reference actions for battery cell float voltage and electrolyte level.
(6) Provide specific Required Actions and increased Completion Times for out-of-limits conditions for battery cell float voltage, electrolyte level, and electrolyte temperature.
(7) Require only one DC electrical power subsystem and two inverters, respectively, during shutdown conditions. Each of the four AC instrument buses (i.e., 2 per division) is normally supplied AC electrical power by a dedicated inverter.

<u>The following changes are proposed for TS 3.8.4</u>

- Two new Required Actions with associated Completion Times are proposed for Condition A for one battery charger inoperable. The two Required Actions for an inoperable battery charger are to restore the battery terminal voltage to greater than or equal to the minimum established float voltage in two hours and to verify the battery float current $\leq$ 3 amps once per 12 hours.
- The Completion Time for proposed Required Action A.4 for restoring a battery charger to operable status is extended from 24 hours to seven days.

- The Completion Time for Required Action B.1 for opening at least one crosstie breaker between crosstied divisions is extended from 60 hours to 204 hours. The 60 hours was based on the 24 hours the opposite unit would have to restore the inoperable charger (i.e., Required Action A.2) plus the 36 hours the opposite unit would have to reach Mode 5 if the charger is not restored to operable status (i.e., Required Action E.1). Similarly, the 204 hours is based on the seven days the opposite unit has to restore the inoperable charger (proposed Required Action A.4) plus the 36 hours the opposite unit has to reach Mode 5 if the charger is not restored to operable status (i.e., Required Action E.1).
- SR 3.8.4.1 for verifying battery terminal voltage is revised to state "Verify battery terminal voltage is greater than or equal to the minimum established float voltage," with the specific limiting value for float voltage relocated to the TS Bases.
- Preventive maintenance SRs 3.8.4.2, 3.8.4.3, 3.8.4.4, and 3.8.4.5 are relocated to a licensee-controlled program.
- SR 3.8.4.6 is renumbered to SR 3.8.4.2. Alternate acceptance criteria are proposed that would allow an actual in-service demonstration that the charger can recharge the battery to the fully charged state within 24 hours while supplying the largest combined demands of the various continuous steady state loads after a battery discharge to the bounding design basis event discharge state. In addition, proposed SR 3.8.4.2 is revised to state, "Verify each battery charger supplies a load equal to the manufacturer's rating at greater than or equal to the minimum established float voltage for ≥ 8 hours," with the specific limiting value for float voltage relocated to the TS Bases.
- SR 3.8.4.7 is renumbered to SR 3.8.4.3 and the references to SR 3.8.4.8 and SR 3.8.4.7 in the SR Note are renumbered to SR 3.8.6.6 and SR 3.8.4.3, respectively.
- SR 3.8.4.8 is moved to TS 3.8.6 and renumbered to SR 3.8.6.6.

<u>The following changes are proposed for TS 3.8.5</u>

- TS 3.8.5 is revised to require only one DC electrical power subsystem during shutdown conditions.
- SR 3.8.5.1 is revised to delete reference to the SRs relocated from TS 3.8.4 and the remaining SRs in the SR Note renumbered.

<u>The following changes are proposed for TS 3.8.6</u>

- The word "Cell" is deleted from TS 3.8.6 and the Limiting Condition for Operation (LCO) is revised to delete reference to Table 3.8.6-1, Battery Cell Parameters Requirements.
- With regard to the specific limits of Table 3.8.6-1, the following limits are relocated to a licensee-controlled program.
    - Category A and B limits for electrolyte level and float voltage
    - Category C specific value limit for electrolyte level
    - Specific gravity requirements are replaced with float current requirements
- Condition A is deleted and replaced with the following new Conditions.
    - Proposed Condition A for one battery with one or more cells with float voltage < 2.07 V
    - Proposed Condition B for one battery with float current > 3 amps
    - Proposed Condition C for one battery with one or more cells with electrolyte level less than minimum established design limits
    - Proposed Condition D for one battery with pilot cell electrolyte temperature less than minimum established design limits
    - Proposed Condition E for two batteries with battery parameters not within limits
- Condition B is renamed Condition F and revised by referencing proposed Conditions B, C, D, and E. In addition, the portions of Condition B that address electrolyte temperature and battery cell parameters not within Category C values are replaced with a Condition that addresses battery cell float voltage and float current.
- The existing SRs and Table 3.8.6-1 are deleted and replaced with SRs for float current, battery pilot and battery cell float voltage, electrolyte level, and pilot cell electrolyte

temperature. The Category A and B limits for electrolyte level and float voltage, the Category C specific limiting value for electrolyte level, and the specific limiting value for pilot cell electrolyte temperature are relocated to a licensee-controlled program.

The following changes are proposed for TS 3.8.8

- TS 3.8.8 is revised to require only two inverters during shutdown conditions. Each of the four AC instrument buses (i.e., 2 per division) is normally supplied AC electrical power by a dedicated inverter.

The following changes are proposed for TS Section 5.5

- A TS 5.0 Administrative Controls program (i.e., TS 5.5.17, Battery Monitoring and Maintenance Program) is created and references actions for battery cell float voltage and electrolyte level. The requirements of this program will be based on the recommendations of IEEE Standard 450-1995 or of the battery manufacturer.

  In TSTF-360, Revision 1, Attachment 3, (i.e., generic Owner's Group (OG) markups), "TSTF Response to NRC Comments on TSTF 360, Rev 0 dated 8/11/00," page 2, the TSTF Position to NRC Comment #4 addressed eliminating the specific "year" reference to IEEE-450. As discussed in Attachment 3, this would allow future programmatic upgrades to approved versions of IEEE-450 without necessitating a license amendment. In Attachment 3, "Insert for Section 5.5," does not contain the "year" reference to IEEE-450. However, in Attachment 5, (i.e., Westinghouse OG (WOG) markups) "Markup Inserts," "INSERT 5.5[X] PROGRAM," page INSERTs (p.5), the "year" reference to IEEE-450 has been retained.

  The version of IEEE-450 that Byron and Braidwood Stations are committed to (i.e., IEEE-450-1995) is documented in the TS Bases. Changes to the TS Bases are evaluated in accordance with the provisions of 10 CFR 50.59, "Changes, tests, and experiments." Thus, adequate control over changes to the applicable IEEE Standard 450 exists to allow the specific IEEE-450 reference to be contained in the TS Bases.
  Eliminating the "year" reference to the applicable IEEE Standard 450 in the TS and maintaining it in the TS Bases is consistent with similar changes previously approved by the NRC in TSTF-363, "Revise Topical Report references in ITS 5.6.5, COLR," and in a License Amendment for Byron and Braidwood Stations "Byron Station, Units 1 and 2 and Braidwood Station, Units 1 and 2 – Request for Technical Specifications Change – Relocation of ASTM Reference Related to Diesel Fuel Oil Testing," dated June 13, 2001 (Reference 3).

F. SAFETY ANALYSIS OF THE PROPOSED CHANGES

(1) Provide an increased Completion Time for an inoperable battery charger.

TS 3.8.4, Required Action A.2 limits the restoration time for an inoperable battery charger to 24 hours. The primary role of the battery charger is in support of maintaining operability of its associated battery. This is accomplished by the charger being of sufficient size to carry the normal steady state DC loads, with sufficient additional capacity to provide some minimal over-potential to the battery. A secondary safety significant function can be attributed to carrying the post-accident DC load after restoration of AC power, i.e., typically 10-15 seconds, the time required for the DG to energize the bus. In analyzed post-accident scenarios, there are no safety-related criteria for recharging a fully discharged battery in any specific time period.

The proposed Completion Time for TS 3.8.4 proposed Required Action A.4 provides a 7-day restoration time for an inoperable battery charger. However, this time is contingent on a focused and tiered approach to assuring adequate battery capability is maintained. The first priority for the operator is to minimize the battery discharge, which is required to be terminated within 2 hours (proposed Required Action A.2). Proposed Required Action A.2 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to operable status or providing an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage. The second tiered action (proposed Required Action A.3) proposes 12-hours to establish that the battery has sufficient capacity to perform its assumed duty cycle as measured by float current ≤ 3 amps, which may involve some recharging of lost capacity that occurred during the initial 2 hours. Given the choice of a plant shutdown in this condition as currently required, versus a 12-hour determination at the end of which it is reasonable to assume the battery can be shown to have its assumed capacity, this is an acceptable relaxation.

(2) Relocate preventive maintenance SRs to licensee-controlled program.

Per SR 3.0.1, when any SR is not met, the LCO is not met. This is based on the premise that SRs represent the minimum acceptable requirements for operability of the required equipment. However, for SRs 3.8.4.2, 3.8.4.3, 3.8.4.4, and 3.8.4.5, failure to meet the SR does not necessarily mean that the equipment is not capable of performing its safety function, and the corrective action is generally a routine or preventive maintenance activity. For example, the Bases for SR 3.8.4.4 identify removal of visible corrosion and tightening of terminal connections as a preventive maintenance SR. SR 3.8.4.3, visible inspection for physical damage or deterioration that could potentially degrade battery performance, is not required for the battery to perform its safety function, but again reflects ongoing preventive maintenance activities. These activities are inappropriate for operability SRs and are better controlled under the maintenance programs for batteries. With regard to the resistance verifications of SR 3.8.4.2 and SR 3.8.4.5, the values of resistance are vendor recommended values; that is, values at which some action should be taken and not necessarily when the operability of the battery is in question. The safety analyses do not assume a specific battery resistance value, but assume the batteries will supply adequate power. Therefore, a key parameter is the overall battery resistance. Between SRs, the resistance of each connection varies independently from all the others. Some of these connection resistances may be higher or lower than others, and the battery may still be able to perform its function and should not be considered inoperable solely because one connector's resistance is high. Overall resistance has a direct impact on operability, however, it is adequately determined as acceptable through completion of the battery service and discharge tests. As such, these activities are also inappropriate for operability SRs and are better controlled under the maintenance programs for batteries.

Furthermore, these SRs are recommended by IEEE-450, and as such, will be addressed by a plant program based on IEEE-450 practices.

(3) Provide alternate testing criteria for battery charger testing.

SR 3.8.4.6 (proposed SR 3.8.4.2) is intended to confirm the charger design capacity. Alternate acceptance criteria are proposed that would allow an actual in-service demonstration that the charger can recharge the battery to the fully charged state within 24 hours while supplying the largest combined demands of the various continuous steady state loads after a battery discharge to the bounding design basis event discharge state. This meets the intent of the existing test and allows for a normal in-place demonstration of the charger capability thereby minimizing the time when the charger would be disconnected from the DC bus.

(4) Replace battery specific gravity monitoring with float current monitoring.

This change proposes to replace battery specific gravity monitoring with float current monitoring. This has been the focus of significant discussions within the IEEE-450 committee and the NRC technical staff. Due to the technical nature of the rationale and justifications, specific "white paper" discussions have been drafted to address this change. They are provided in Attachment 1, "Battery Primer," and Attachment 2, "White Paper by Kyle Floyd," of TSTF-360, Revision 1. These Attachments to the TSTF and the details provided in the proposed Bases in Attachments B-3 and B-4 provide the justification for this change.

(5.1) Relocate to a licensee-controlled program based on IEEE-450 and/or the TS Bases:

- **(a) Category A and B limits for battery cell float voltage and electrolyte level, along with the associated compensatory actions;**
- **(b) Category C specific value limit for electrolyte level;**
- **(c) The specific value limit for electrolyte temperature; and**
- **(d) Specific value for the minimum battery charging float voltage;**

and

(5.2) Create a TS 5.0 Administrative Controls program to reference actions for battery cell float voltage and electrolyte level.

(5.1a) In TS 3.8.6, battery cell float voltage and electrolyte level parameters contain various levels (i.e., Categories) of limitations. The Category A and B limits reflect nominal fully charged battery parameter values. Significant margin, above that required for declaration of an operable battery, is provided in these values. These Category A and B values represent appropriate monitoring levels and appropriate preventive maintenance levels for long term battery quality and extended battery life. As such, they do not reflect the 10 CFR 50.36 criteria for LCOs of "the lowest functional capability or performance levels of equipment required for safe operation of the facility." It is proposed that these values, and the Required Actions associated with restoration, be relocated to a licensee-controlled program that is under the control of 10 CFR 50.59, "Changes, tests, and experiments." This program is to be based on the recommendations of IEEE-450-1995. The battery parameter values will continue to be controlled at their current level, and actions will be implemented in accordance with the plant corrective action program. Furthermore, the battery and its preventive maintenance and monitoring are under the regulatory requirements of 10 CFR 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants." This relocation will continue to assure the battery is maintained at current levels of performance, and allows the TS and the licensed operators to focus on battery parameter degradations that approach, but continue to provide some margin to, levels that may impact battery operability.

(5.1b)(5.1c) The specific limiting values for the battery electrolyte temperature and level are also relocated to a licensee-controlled program that is under the control of 10 CFR 50.59. The TS will require the electrolyte temperature and level to be greater than or equal to minimum established design limits. Depending on the available excess capacity of the associated battery, the minimum temperature necessary to support operability of the battery can vary.

Relocation to a licensee-controlled program will allow the flexibility to monitor and control this limit at values directly related to the battery's ability to perform its assumed function.

(5.1d) The specific limiting value for the minimum operating battery charging float voltage is relocated to the Bases, which are under the change control of 10 CFR 50.59. TS will require the battery charger to supply battery terminal voltage greater than or equal to the minimum established float voltage. The battery manufacturer establishes this voltage to provide the optimum charge on the battery. This voltage will maintain the battery plates in a condition that supports maintaining the grid life. As such the minimum established float voltage can be adequately controlled outside of the TS.

(5.2) The Actions related to the following two parameters are specified by a new TS 5.0 Administrative Controls program (i.e., battery cell float voltage < 2.13 V and restoration and testing of battery cells that had electrolyte level below the top of the plates).

(6) Provide specific Required Actions and increased Completion Times for out-of-limits conditions for battery cell float voltage, electrolyte level, and electrolyte temperature.

The remaining parameter limits are proposed to have more specific actions associated with each parameter that recognizes its unique impact on the battery and its continued operability. The proposed change provides specific Required Actions and increased Completion Times for out-of-limits conditions for battery cell float voltage, electrolyte level, and electrolyte temperature. These allowed times recognize the margins available, the minimal impact on the battery capacity and capability to perform its intended function, and the likelihood of affecting restoration in a timely fashion avoiding an unnecessary plant shutdown. The Bases provides specific justification for each proposed Required Action.

(7) Require only one DC electrical power subsystem and two inverters, respectively, during shutdown conditions.

The proposed changes associated with TSTF-204, Revision 3, revise TS 3.8.5 and TS 3.8.8 to require only one DC electrical power subsystem and two inverters, respectively, during shutdown conditions. This option to require only one DC electrical power subsystem and two inverters during shutdown conditions applies to plants having a pre-Improved TS (ITS) licensing basis for electrical power requirements during shutdown conditions that required only one DC electrical power subsystem and two inverters to be operable. Each of the four AC instrument buses (i.e., 2 per division) is normally supplied AC electrical power by a dedicated inverter. The Braidwood and Byron Stations' pre-ITS licensing basis for electrical power requirements during shutdown conditions required only one DC electrical power subsystem and two inverters to be operable.

The shutdown TS requirements are designed to ensure that the unit has the capability to mitigate the consequences of certain postulated accidents. Worst case DBAs, which are analyzed for operating modes, are generally viewed not to be a significant concern during shutdown modes due to the lower energies involved. The TS therefore require a lesser complement of electrical equipment to be available during shutdown than is required during operating modes. More recent work completed on the potential risks associated with shutdown, however, has found significant risk associated with certain shutdown evolutions. As a result, in addition to the requirements established in the TS, the industry has adopted NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management," as an industry initiative to manage shutdown tasks and associated electrical support to maintain risk at an acceptable low level.

G. IMPACT ON PREVIOUS SUBMITTALS

We have reviewed the proposed changes regarding their impact on any previous submittals and have determined that there is no impact on any previous submittals.

H. SCHEDULE REQUIREMENTS

We request approval of the proposed change prior to September 8, 2002.

I. REFERENCES

(1) TSTF Standard TS Change Traveler TSTF-360, Revision 1, DC Electrical Rewrite

(2) TSTF Standard TS Change Traveler TSTF-204, Revision 3, Revise DC Sources – Shutdown and Inverters – Shutdown to Address Specific Subsystem Requirements

(3) Letter from M. Chawla (NRC) to O. D. Kingsley, "Byron Station, Units 1 and 2 and Braidwood Station, Units 1 and 2 – Request for Technical Specifications Change – Relocation of ASTM Reference Related to Diesel Fuel Oil Testing," dated June 13, 2001

(4) Letter from J. B. Hopkins (NRC) to O. D. Kingsley (Exelon Generation Company, LLC), "Clinton Power Station, Unit 1 – Issuance of Amendment," dated February 15, 2002

ATTACHMENT B-1

PROPOSED TS CHANGES FOR BRAIDWOOD STATION, UNITS 1 AND 2

MARKED-UP TS PAGES

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources-Operating

LCO 3.8.4 Division 11(21) and Division 12(22) DC electrical power subsystems shall be OPERABLE and not crosstied to the opposite unit.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One battery charger inoperable.	A.1 Crosstie opposite-unit bus with associated OPERABLE battery charger to the affected division. AND A.2 Restore battery terminal voltage to greater than or equal to the minimum established float voltage. AND A.3 Verify battery float current $\leq$ 3 amps. AND A.~~2~~ 4 Restore battery charger to OPERABLE status.	2 hours 2 hours (A.2) Once per 12 hours (A.3) ~~24 hours~~ 7days
B. One DC electrical power division crosstied to opposite-unit DC electrical power subsystem that has an inoperable battery charger, while opposite unit is in MODE 1, 2, 3, or 4.	B.1 Open at least one crosstie breaker between the crosstied divisions.	~~60~~ 204 hours

(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is ~~≥ 127.6 V on float charge~~. greater than or equal to the minimum established float voltage.	7 days
SR 3.8.4.2	Verify no visible corrosion at battery terminals and connectors. OR Verify battery connection resistance is ≤ 1.5E-4 ohm for inter-cell connections, ≤ 1.5E-4 ohm for inter-rack connections, ≤ 1.5E-4 ohm for inter-tier connections, and ≤ 1.5E-4 ohm for terminal connections.	92 days
SR 3.8.4.3	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration that could degrade battery performance.	18 months
SR 3.8.4.4	Remove visible terminal corrosion, verify battery cell to cell and terminal connections are clean and tight, and are coated with anti-corrosion material.	18 months
SR 3.8.4.5	Verify battery connection resistance is ≤ 1.5E-4 ohm for inter-cell connections, ≤ 1.5E-4 ohm for inter-rack connections, ≤ 1.5E-4 ohm for inter-tier connections, and ≤ 1.5E-4 ohm for terminal connections.	18 months

(continued)

OR

Verify each battery charger can recharge the battery to the fully charged state within 24 hours while supplying the largest coincident demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.~~6~~ 2	Verify each battery charger supplies a load equal to the manufacturer's rating at greater than or equal to the minimum established float voltage for ≥ 8 hours.	18 months
SR 3.8.4.~~7~~ 3	-------------------NOTES------------------- 1. The modified performance discharge test in SR 3.8.~~4.8~~ 6.6 may be performed in lieu of the service test in SR 3.8.4.~~7~~. 3 2. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. --- Verify battery capacity is adequate to supply, and maintain OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.	18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.~~4.8~~ 6.6	------------------NOTE------------------ This Surveillance shall not be performed in MODE 1, 2, 3, or 4. --	
	Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.	60 months <u>AND</u> 12 months when battery shows degradation or has reached 85% of the expected life with capacity < 100% of manufacturer's rating <u>AND</u> 24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating
Moved to TS 3.8.6 (SR 3.8.6.6)		

TSTF-204

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources-Shutdown

LCO 3.8.5 ~~The following~~ One DC electrical power subsystem shall be OPERABLE~~(S)~~.

~~a.~~ One DC electrical power subsystem ~~capable of supplying one division of the onsite Class 1E DC electrical power distribution subsystem(s) required by LCO 3.8.10, "Distribution System-Shutdown," with at least one unit crosstie breaker open; and~~

~~b. One source of DC electrical power, other than that required by LCO 3.8.5.a, capable of supplying the remaining onsite Class 1E DC electrical power distribution subsystem(s) when required by LCO 3.8.10.~~

---------------------------NOTE---------------------------

The required DC electrical power subsystem ~~One division~~ may be crosstied to the opposite unit, when the opposite unit is in MODE 1, 2, 3, or 4 with an inoperable battery charger.

APPLICABILITY: MODES 5 and 6,
During movement of irradiated fuel assemblies.

ACTIONS

---------------------------NOTE---------------------------

LCO 3.0.3 is not applicable.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ~~or more~~ required DC electrical power subsystems inoperable for reasons other than Condition B.	A.1 Declare affected required feature(s) inoperable. OR	Immediately (continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. (continued)	A.2.1	Suspend CORE ALTERATIONS.	Immediately
	AND		
	A.2.2	Suspend movement of irradiated fuel assemblies.	Immediately
	AND		
	A.2.3	Initiate action to suspend operations involving positive reactivity additions.	Immediately
	AND		
	A.2.4	Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately
	AND		
	A.2.5	Declare affected Low Temperature Overpressure Protection feature(s) inoperable.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. One required DC electrical power ~~division~~ subsystem crosstied to opposite-unit DC electrical power subsystem with an inoperable source, while opposite unit is in MODE 5, 6, or defueled.	B.1	---------NOTE-------- Only required when opposite unit has an inoperable battery. -------------------- Verify opposite-unit DC bus load is ≤ 200 amps.	Once per 12 hours
	<u>AND</u>		
	B.2	Open at least one crosstie breaker between the crosstied divisions.	7 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.5.1	-------------------NOTE------------------- The following SRs are not required to be performed: SR 3.8.4.~~6~~ 2 and SR 3.8.4.~~7~~ 3 ~~and SR 3.8.4.8~~. -- For DC sources required to be OPERABLE, the following SRs are applicable: SR 3.8.4.1 ~~SR 3.8.4.5~~ SR 3.8.4.2 ~~SR 3.8.4.6~~ SR 3.8.4.3 ~~SR 3.8.4.7~~ ~~SR 3.8.4.4~~ ~~SR 3.8.4.8~~	In accordance with applicable SRs

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery ~~Cell~~ Parameters

LCO 3.8.6 Battery ~~cell~~ parameters for Division 11(21) and Division 12(22) batteries shall be within limits ~~of Table 3.8.6-1~~.

APPLICABILITY: When associated DC electrical power subsystems are required to be OPERABLE.

ACTIONS

------------------------------------NOTE------------------------------------
Separate Condition entry is allowed for each battery.

3.8.6 Insert

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~A. One or more batteries with one or more battery cell parameters not within Category A or B limits.~~	~~A.1 Verify pilot cell electrolyte level and float voltage meet Table 3.8.6-1 Category C limits.~~	~~1 hour~~
	~~AND~~	
	~~A.2 Verify battery cell parameters meet Table 3.8.6-1 Category C limits.~~	~~24 hours~~ ~~AND~~ ~~Once per 7 days thereafter~~
	~~AND~~	
	~~A.3 Restore battery cell parameters to Category A and B limits of Table 3.8.6-1.~~	~~31 days~~

(continued)

3.8.6 Insert

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One battery with one or more cells with float voltage < 2.07 V.	A.1	Perform SR 3.8.4.1.	2 hours
	<u>AND</u>		
	A.2	Perform SR 3.8.6.1.	2 hours
	<u>AND</u>		
	A.3	Restore affected cell float voltage to ≥ 2.07 V.	24 hours
B. One battery with float current > 3 amps.	B.1	Perform SR 3.8.4.1.	2 hours
	<u>AND</u>		
	B.2	Restore battery float current to ≤ 3 amps.	12 hours
C. ---------NOTE--------- Required Action C.2 must be completed if electrolyte level was below the top of plates. --------------------- One battery with one or more cells with electrolyte level less than minimum established design limits.	------------NOTE------------ Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of plates. ----------------------------		
	C.1	Restore affected cell electrolyte level to above the top of plates.	8 hours
	<u>AND</u>		
	C.2	Verify no evidence of leakage.	12 hours
	<u>AND</u>		
	C.3	Restore affected cell electrolyte level to greater than or equal to minimum established design limits.	31 days

D.	One battery with pilot cell electrolyte temperature less than minimum established design limits.	D.1	Restore pilot cell electrolyte temperature to greater than or equal to minimum established design limits.	12 hours
E.	Two batteries with battery parameters not within limits.	E.2	Restore battery parameters for one battery to within limits.	2 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F ~~B~~. Required Action and associated Completion Time of Condition A, B, C, D, or E not met. OR ~~One or more batteries with average electrolyte temperature of the representative cells < 60°F.~~ ~~OR~~ ~~One or more batteries with one or more battery cell parameters not within Category C values.~~ One battery with one or more cells with float voltage < 2.07V and float current > 3 amps.	F ~~B~~.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
——NOTE—— Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. ———— SR 3.8.6.1 Verify each battery float current is ≤ 3 amps ~~battery cell parameters meet Table 3.8.6-1 Category A limits.~~	7 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.6.2	each battery pilot cell float voltage is ≥ 2.07V Verify ~~battery cell parameters meet Table 3.8.6-1 Category B limits~~.	31 ~~92~~ days ~~AND~~ ~~Once within 7 days after a battery discharge < 110 V~~ ~~AND~~ ~~Once within 7 days after a battery overcharge > 145 V~~
SR 3.8.6.3	each battery cell electrolyte level is greater than or equal to minimum established design limits Verify ~~average electrolyte temperature of representative cells is ≥ 60°F~~.	31 ~~92~~ days
SR 3.8.6.4	Verify each battery pilot cell electrolyte temperature is greater than or equal to minimum established design limits.	31 days
SR 3.8.6.5	Verify each battery cell float voltage is ≥ 2.07V.	92 days
SR 3.8.6.6	<see SR 3.8.4.8 markup>	

Table 3.8.6-1 (page 1 of 1)
Battery Cell Parameters Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE LIMITS FOR EACH CONNECTED CELL
Electrolyte Level	> Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark[(a)]	> Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark[(a)]	Above top of plates, and not overflowing
Float Voltage	≥ 2.13 V	≥ 2.13 V[(b)]	> 2.07 V
Specific Gravity[(c)(d)]	≥ 1.200	≥ 1.195 AND Average of all connected cells > 1.205	Not more than 0.020 below average of all connected cells AND Average of all connected cells ≥ 1.195

(a) It is acceptable for the electrolyte level to temporarily increase above the specified maximum during equalizing charges provided it is not overflowing.
(b) Corrected for average electrolyte temperature.
(c) Corrected for electrolyte temperature.
(d) A battery charging current of < 3 amps when on float charge is acceptable for meeting specific gravity limits following a battery recharge, for a maximum of 7 days. When charging current is used to satisfy specific gravity requirements, specific gravity of each connected cell shall be measured prior to expiration of the 7 day allowance.

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3.8 ELECTRICAL POWER SYSTEMS

3.8.8 Inverters-Shutdown

LCO 3.8.8 ~~The following~~ shall be OPERABLE:

~~a.~~ Two inverters ~~capable of supplying one division of the onsite Class 1E AC instrument bus electrical power distribution subsystem(s) required by LCO 3.8.10, "Distribution System-Shutdown"; and~~

~~b. One source of instrument bus power, other than that required by LCO 3.8.8.a, capable of supplying the remaining onsite Class 1E AC instrument bus electrical power distribution subsystem(s) when required by LCO 3.8.10.~~

APPLICABILITY: MODES 5 and 6,
During movement of irradiated fuel assemblies.

ACTIONS

-----------------------------------NOTE-----------------------------------
LCO 3.0.3 is not applicable.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required ~~AC instrument bus power sources~~ inverters inoperable.	A.1 Declare affected required feature(s) inoperable. OR	Immediately (continued)

5.5 Programs and Manuals

5.5.16 Containment Leakage Rate Testing Program (continued)

b. Air lock testing acceptance criteria are:

1. Overall air lock leakage rate is ≤ 0.05 L_a when tested at ≥ P_a; and

2. For each door, seal leakage rate is:

   i. < 0.0024 L_a, when pressurized to ≥ 3 psig, and

   ii. < 0.01 L_a, when pressurized to ≥ 10 psig.

The provisions of SR 3.0.2 do not apply to the test frequencies specified in the Containment Leakage Rate Testing Program.

The provisions of SR 3.0.3 are applicable to the Containment Leakage Rate Testing Program.

5.5.17 Battery Monitoring and Maintenance Program

This program provides for restoration and maintenance, based on the recommendations of IEEE Standard 450, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries For Stationary Applications," or of the battery manufacturer of the following:

a. Actions to restore battery cells with float voltage < 2.13V, and

b. Actions to equalize and test battery cells that had been discovered with electrolyte level below the minimum established design limit.

ATTACHMENT B-2

PROPOSED TS CHANGES FOR BYRON STATION, UNITS 1 AND 2

MARKED-UP TS PAGES

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources-Operating

LCO 3.8.4 Division 11(21) and Division 12(22) DC electrical power subsystems shall be OPERABLE and not crosstied to the opposite unit.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One battery charger inoperable.	A.1	Crosstie opposite-unit bus with associated OPERABLE battery charger to the affected division.	2 hours
	AND		
	A.2	Restore battery terminal voltage to greater than or equal to the minimum established float voltage.	2 hours (A.2)
	AND		
	A.3	Verify battery float current ≤ 3 amps.	Once per 12 hours (A.3)
	AND		
	A.~~2~~ 4	Restore battery charger to OPERABLE status.	~~24 hours~~ 7 days
B. One DC electrical power division crosstied to opposite-unit DC electrical power subsystem that has an inoperable battery charger, while opposite unit is in MODE 1, 2, 3, or 4.	B.1	Open at least one crosstie breaker between the crosstied divisions.	~~60~~ 204 hours

(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is ~~≥ 127.6 V on float charge.~~ greater than or equal to the minimum established float voltage.	7 days
SR 3.8.4.2	Verify no visible corrosion at battery terminals and connectors. OR Verify battery connection resistance is ≤ 1.5E-4 ohm for inter-cell connections, ≤ 1.5E-4 ohm for inter-rack connections, ≤ 1.5E-4 ohm for inter-tier connections, and ≤ 1.5E-4 ohm for terminal connections.	92 days
SR 3.8.4.3	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration that could degrade battery performance.	18 months
SR 3.8.4.4	Remove visible terminal corrosion, verify battery cell to cell and terminal connections are clean and tight, and are coated with anti-corrosion material.	18 months
SR 3.8.4.5	Verify battery connection resistance is ≤ 1.5E-4 ohm for inter-cell connections, ≤ 1.5E-4 ohm for inter-rack connections, ≤ 1.5E-4 ohm for inter-tier connections, and ≤ 1.5E-4 ohm for terminal connections.	18 months

(continued)

OK.
Verify each battery charger can recharge the battery to the fully charged state within 24 hours while supplying the largest coincident demands of the various continuous steady state loads, after a battery discharge to the bounding design basis event discharge state.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.~~6~~ 2	Verify each battery charger supplies a load equal to the manufacturer's rating at greater than or equal to the minimum established float voltage for ≥ 8 hours.	18 months
SR 3.8.4.~~7~~ 3	-------------------NOTES------------------- 1. The modified performance discharge test in SR 3.8.~~4.8~~ 6.6 may be performed in lieu of the service test in SR 3.8.4.~~7~~.3 2. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. -- Verify battery capacity is adequate to supply, and maintain OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.	 18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.~~4.8~~ 6.6	-------------------NOTE------------------- This Surveillance shall not be performed in MODE 1, 2, 3, or 4. -- Verify battery capacity is ≥ 80% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.	60 months AND 12 months when battery shows degradation or has reached 85% of the expected life with capacity < 100% of manufacturer's rating AND 24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating

Moved to TS 3.8.6 (SR 3.8.6.6)

TSTF-204

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources-Shutdown

LCO 3.8.5 ~~The following~~ One DC electrical power subsystem shall be OPERABLE~~:~~.

~~a.~~ One DC electrical power subsystem ~~capable of supplying one division of the onsite Class 1E DC electrical power distribution subsystem(s) required by LCO 3.8.10, "Distribution System-Shutdown," with at least one unit crosstie breaker open; and~~

~~b.~~ ~~One source of DC electrical power, other than that required by LCO 3.8.5.a, capable of supplying the remaining onsite Class 1E DC electrical power distribution subsystem(s) when required by LCO 3.8.10.~~

NOTE

~~One division~~ The required DC electrical power subsystem may be crosstied to the opposite unit, when the opposite unit is in MODE 1, 2, 3, or 4 with an inoperable battery charger.

APPLICABILITY: MODES 5 and 6,
During movement of irradiated fuel assemblies.

ACTIONS

NOTE

LCO 3.0.3 is not applicable.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ~~or more~~ required DC electrical power subsystems inoperable for reasons other than Condition B.	A.1 Declare affected required feature(s) inoperable. OR	Immediately (continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u>	
	A.2.2 Suspend movement of irradiated fuel assemblies.	Immediately
	<u>AND</u>	
	A.2.3 Initiate action to suspend operations involving positive reactivity additions.	Immediately
	<u>AND</u>	
	A.2.4 Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately
	<u>AND</u>	
	A.2.5 Declare affected Low Temperature Overpressure Protection feature(s) inoperable.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. One required DC electrical power ~~division~~ subsystem crosstied to opposite-unit DC electrical power subsystem with an inoperable source, while opposite unit is in MODE 5, 6, or defueled.	B.1 ---------NOTE-------- Only required when opposite unit has an inoperable battery. -------------------- Verify opposite-unit DC bus load is ≤ 200 amps.	 Once per 12 hours
	AND	
	B.2 Open at least one crosstie breaker between the crosstied divisions.	7 days

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.5.1	------------------NOTE------------------ The following SRs are not required to be performed: SR 3.8.4.~~6~~2, and SR 3.8.4.~~7~~3 ~~and SR 3.8.4.8~~. -- For DC sources required to be OPERABLE, the following SRs are applicable: SR 3.8.4.1 ~~SR 3.8.4.5~~ SR 3.8.4.2 ~~SR 3.8.4.6~~ SR 3.8.4.3 ~~SR 3.8.4.7~~ ~~SR 3.8.4.4~~ ~~SR 3.8.4.8.~~	In accordance with applicable SRs

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery ~~Cell~~ Parameters

LCO 3.8.6 Battery ~~cell~~ parameters for Division 11(21) and Division 12(22) batteries shall be within limits ~~of Table 3.8.6-1~~.

APPLICABILITY: When associated DC electrical power subsystems are required to be OPERABLE.

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each battery.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more batteries with one or more battery cell parameters not within Category A or B limits.	A.1	Verify pilot cell electrolyte level and float voltage meet Table 3.8.6-1 Category C limits.	1 hour
	<u>AND</u>		
	A.2	Verify battery cell parameters meet Table 3.8.6-1 Category C limits.	24 hours <u>AND</u> Once per 7 days thereafter
	<u>AND</u>		
	A.3	Restore battery cell parameters to Category A and B limits of Table 3.8.6-1.	31 days

3.8.6 Insert

(continued)

3.8.6 Insert

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One battery with one or more cells with float voltage < 2.07 V.	A.1 Perform SR 3.8.4.1.	2 hours
	<u>AND</u>	
	A.2 Perform SR 3.8.6.1.	2 hours
	<u>AND</u>	
	A.3 Restore affected cell float voltage to ≥ 2.07 V.	24 hours
B. One battery with float current > 3 amps.	B.1 Perform SR 3.8.4.1.	2 hours
	<u>AND</u>	
	B.2 Restore battery float current to ≤ 3 amps.	12 hours
C. ---------NOTE--------- Required Action C.2 must be completed if electrolyte level was below the top of plates. --------------------- One battery with one or more cells with electrolyte level less than minimum established design limits.	------------NOTE------------ Required Actions C.1 and C.2 are only applicable if electrolyte level was below the top of plates. ----------------------------	
	C.1 Restore affected cell electrolyte level to above the top of plates.	8 hours
	<u>AND</u>	
	C.2 Verify no evidence of leakage.	12 hours
	<u>AND</u>	
	C.3 Restore affected cell electrolyte level to greater than or equal to minimum established design limits.	31 days

D. One battery with pilot cell electrolyte temperature less than minimum established design limits.	D.1 Restore pilot cell electrolyte temperature to greater than or equal to minimum established design limits.	12 hours
E. Two batteries with battery parameters not within limits.	E.2 Restore battery parameters for one battery to within limits.	2 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F ~~B.~~ Required Action and associated Completion Time of Condition A, B, C, D, or E not met. OR ~~One or more batteries with average electrolyte temperature of the representative cells < 60°F.~~ ~~OR~~ ~~One or more batteries with one or more battery cell parameters not within Category C values.~~ One battery with one or more cells with float voltage ≤ 2.07V and float current > 3 amps.	F ~~B~~.1 Declare associated battery inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.8.6.1 ------------ NOTE ------------ Not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. Verify each battery float current is ≤ 3 amps ~~battery cell parameters meet Table 3.8.6-1 Category A limits~~.	7 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.6.2	each battery pilot cell float voltage is ≥ 2.07V Verify ~~battery cell parameters meet Table 3.8.6-1 Category B limits~~.	31 ~~92~~ days ~~AND~~ ~~Once within 7 days after a battery discharge < 110 V~~ ~~AND~~ ~~Once within 7 days after a battery overcharge > 145 V~~
SR 3.8.6.3	each battery cell electrolyte level is greater than or equal to minimum established design limits Verify ~~average electrolyte temperature of representative cells is ≥ 60°F.~~	31 ~~92~~ days
SR 3.8.6.4	Verify each battery pilot cell electrolyte temperature is greater than or equal to minimum established design limits	31 days
SR 3.8.6.5	Verify each battery cell float voltage is ≥ 2.07 V.	92 days
SR 3.8.6.6	⟨see SR 3.8.4.8 markup⟩	

Table 3.8.6-1 (page 1 of 1)
Battery Cell Parameters Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE LIMITS FOR EACH CONNECTED CELL
Electrolyte Level	> Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark[a]	> Minimum level indication mark, and ≤ ¼ inch above maximum level indication mark[a]	Above top of plates, and not overflowing
Float Voltage	≥ 2.13 V	≥ 2.13 V[b]	> 2.07 V
Specific Gravity[c][d]	≥ 1.200	≥ 1.195 AND Average of all connected cells > 1.205	Not more than 0.020 below average of all connected cells AND Average of all connected cells ≥ 1.195

(a) It is acceptable for the electrolyte level to temporarily increase above the specified maximum during equalizing charges provided it is not overflowing.

(b) Corrected for average electrolyte temperature.

(c) Corrected for electrolyte temperature.

(d) A battery charging current of < 3 amps when on float charge is acceptable for meeting specific gravity limits following a battery recharge, for a maximum of 7 days. When charging current is used to satisfy specific gravity requirements, specific gravity of each connected cell shall be measured prior to expiration of the 7 day allowance.

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3.8 ELECTRICAL POWER SYSTEMS

3.8.8 Inverters-Shutdown

LCO 3.8.8 ~~The following~~ Two inverters shall be OPERABLE.

~~a.~~ ~~Two inverters capable of supplying one division of the onsite Class 1E AC instrument bus electrical power distribution subsystem(s) required by LCO 3.8.10, "Distribution System-Shutdown"; and~~

~~b.~~ ~~One source of instrument bus power, other than that required by LCO 3.8.8.a, capable of supplying the remaining onsite Class 1E AC instrument bus electrical power distribution subsystem(s) when required by LCO 3.8.10.~~

APPLICABILITY: MODES 5 and 6,
During movement of irradiated fuel assemblies.

ACTIONS

------------------------------------NOTE------------------------------------
LCO 3.0.3 is not applicable.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more required ~~AC instrument bus power sources~~ inverters inoperable.	A.1	Declare affected required feature(s) inoperable.	Immediately
	<u>OR</u>		
			(continued)

5.5 Programs and Manuals

5.5.16 Containment Leakage Rate Testing Program (continued)

b. Air lock testing acceptance criteria are:

1. Overall air lock leakage rate is ≤ 0.05 L_a when tested at ≥ P_a; and

2. For each door, seal leakage rate is:

i. < 0.0024 L_a, when pressurized to ≥ 3 psig, and

ii. < 0.01 L_a, when pressurized to ≥ 10 psig.

The provisions of SR 3.0.2 do not apply to the test frequencies specified in the Containment Leakage Rate Testing Program.

The provisions of SR 3.0.3 are applicable to the Containment Leakage Rate Testing Program.

5.5.17 Battery Monitoring and Maintenance Program

This program provides for restoration and maintenance, based on the recommendations of IEEE Standard 450, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries For Stationary Applications," or of the battery manufacturer of the following:

a. Actions to restore battery cells with float voltage < 2.13 V, and
b. Actions to equalize and test battery cells that had been discovered with electrolyte level below the minimum established design limit.

ATTACHMENT B-3

INCORPORATED TS BASES CHANGES FOR BRAIDWOOD STATION, UNITS 1 AND 2
FOR INFORMATION ONLY

INCORPORATED TS BASES PAGES

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources – Operating

BASES

BACKGROUND

The station DC electrical power system provides the AC emergency power system with control power. It also provides both motive and control power to selected safety related equipment and AC instrument bus power (via inverters). As required by 10 CFR 50, Appendix A, GDC 17 (Ref. 1), the DC electrical power system is designed to have sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure. The DC electrical power system also conforms to the recommendations of Regulatory Guide 1.6 (Ref. 2) and IEEE-308 (Ref. 3).

The 125 VDC electrical power system for each unit consists of two independent and redundant safety related Class 1E DC electrical power subsystems (Division 11 (21) and Division 12 (22)). Each subsystem consists of one 125 VDC battery, the associated battery charger for each battery, and all the associated control equipment and interconnecting cabling.

During normal operation, the 125 VDC loads are powered from the battery chargers with the batteries floating on the system. In case of a loss of normal power to the battery charger, the DC load is automatically powered from the station battery.

The Division 11 (21) and Division 12 (22) DC electrical power subsystems provide the control power for its associated Class 1E AC power load group, 4.16 kV switchgear, and 480 V load centers. The DC electrical power subsystems also provide DC electrical power to the inverters, which in turn power the AC instrument buses. Additionally, the Class 1E 125 VDC electrical power subsystems provide power to the 6.9 kV Reactor Coolant Pump (RCP) breakers and the non-Class 1E 125 VDC buses. The connection between the Class 1E and non-Class 1E 125 VDC buses contains fuses to ensure that a fault on the non-Class 1E bus does not cause a loss of the Class 1E bus.

BASES

BACKGROUND (continued)

The DC power distribution system is described in more detail in Bases for LCO 3.8.9, "Distribution System – Operating," and LCO 3.8.10, "Distribution Systems – Shutdown."

Each 125 VDC battery is separately housed in a ventilated room apart from its charger and distribution centers. Each subsystem is located in an area separated physically and electrically from the other subsystem to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems, such as batteries, battery chargers, or distribution panels. While it is possible to interconnect the Unit 1 and Unit 2 DC electrical power subsystems, they normally remain disconnected, except when a DC source must be taken out of service for the purposes of maintenance and/or testing, or in the event of a failure of a DC source.

The crosstie between 125 VDC ESF buses 111 and 211 and the crosstie between 125 VDC ESF buses 112 and 212 are each provided with two normally locked open, manually operated circuit breakers. No interlocks are provided since the interconnected buses are not redundant. However, if one battery is inoperable, procedural and administrative controls are used to limit the connected load to 200 amps based on not exceeding the OPERABLE battery capacity. These controls ensure that combinations of maintenance and test operations will not preclude the system capabilities to supply power to the ESF DC loads. The provisions of administratively controlled, manually actuated, interconnections between the non-redundant Class 1E DC buses increases the overall reliability and availability of the DC systems for each unit in that it provides a means for manually providing power to a DC bus at a time when it would otherwise have to be out-of-service (e.g., to perform a battery discharge test during an outage, to replace a damaged cell, etc.). Crosstie breaker closed alarms are also provided to alert the operator when the units are crosstied.

BASES

BACKGROUND (continued)

Each battery has adequate storage capacity to meet the duty cycle(s) discussed in UFSAR, Chapter 8 (Ref. 4). The battery is designed with additional capacity above that required by the design duty cycle to allow for temperature variations and other factors.

The Division 11 (21) and Division 12 (22) DC electrical power subsystem batteries are sized to produce required capacity at 80% of nameplate rating, corresponding to warranted capacity at end of life cycles and the 100% design demand. The minimum design voltage limit is 108 volts.

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 120 volts for a 58 cell battery (i.e., cell voltage of 2.065 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.065 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage 2.20 to 2.25 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.22 Vpc corresponds to a total float voltage output of 128.8 volts for a 58 cell battery as discussed in UFSAR, Chapter 8 (Ref. 4).

Each Division 11 (21) and Division 12 (22) DC electrical power subsystem battery charger has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger also has sufficient excess capacity to restore the battery from the design minimum charge to its fully charged state within 24 hours while supplying normal steady state loads discussed in the UFSAR, Chapter 8 (Ref. 4).

The battery charger is normally in the float-charge mode. Float-charge is the condition in which the charger is supplying the connected loads and the battery cells are receiving adequate current to optimally charge the battery. This assures the internal losses of a battery are overcome and the battery is maintained in a fully charged state.

BASES

BACKGROUND (continued)

When desired, the charger can be placed in the equalize mode. The equalize mode is at a higher voltage than the float mode and charging current is correspondingly higher. The battery charger is operated in the equalize mode after a battery discharge or for routine maintenance. Following a battery discharge, the battery recharge characteristic accepts current at the current limit of the battery charger if the discharge was significant, e.g., following a battery service test, until the battery terminal voltage approaches the charger voltage setpoint. Charging current then reduces exponentially during the remainder of the recharge cycle. Lead-calcium batteries have recharge efficiencies of greater than 95%, so once at least 105% of the ampere-hours discharged have been returned, the battery capacity would be restored to the same condition as it was prior to the discharge. This can be monitored by direct observation of the exponentially decaying charging current or by evaluating the amp-hours discharged from the battery and amp-hours returned to the battery.

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 6 (Ref. 5), and in the UFSAR, Chapter 15 (Ref. 6), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the DGs, emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC sources is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the plant. This includes maintaining the DC electrical power distribution subsystem OPERABLE during accident conditions in the event of:

a. An assumed loss of all offsite AC power or all onsite AC power sources; and

b. A worst case single failure.

The DC sources satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

BASES

LCO

The DC electrical power subsystems, each subsystem consisting of:

a. a battery;

b. battery charger; and

c. the corresponding control equipment and interconnecting cabling supplying power to the associated bus within the division,

are required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an Anticipated Operational Occurrence (AOO) or a postulated DBA. Loss of any division DC electrical power subsystem does not prevent the minimum safety function from being performed (Ref. 4). Furthermore, at least one crosstie breaker between Division 11 and Division 21, and at least one crosstie breaker between Division 12 and Division 22, is required to be open to maintain independence between the units.

An OPERABLE DC electrical power subsystem requires the required battery and respective charger to be operating and connected to the associated DC bus.

APPLICABILITY

The DC electrical power sources are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure safe unit operation and to ensure that:

a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and

b. Adequate core cooling is provided, and containment integrity and other vital functions are maintained in the event of a postulated DBA.

The DC electrical power requirements for MODES 5 and 6 are addressed in LCO 3.8.5, "DC Sources – Shutdown."

BASES

ACTIONS

A.1, A.2, A.3 and A.4

Condition A addresses the event of having one battery charger inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained). The ACTIONS provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to OPERABLE status in a reasonable time period.

Required Action A.1 provides for restoration of electrical power to the associated DC bus by use of the crosstie capability to the opposite unit. The 2 hour Completion Time allows adequate time to evaluate the cause for battery charger failure, to determine whether the opposite unit's DC bus is available for support, and to perform the crosstie procedure. The battery charger is required to be restored to OPERABLE status within 7 days in order to reestablish the independence of DC subsystems, while providing a reasonable amount of time for repairs. By limiting the crosstied conditions of operating units to 7 days, the likelihood of an event occurring which could place either unit in jeopardy is minimized. (Note, there are no load restrictions applicable to the opposite unit's DC bus in this condition.)

BASES

ACTIONS (continued)

Required Action A.2 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage. Restoring the battery terminal voltage to greater than or equal to the minimum established float voltage provides good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action A.3) from any discharge that might have occurred due to the charger inoperability. A discharged battery having terminal voltage of at least the minimum established float voltage indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of the previous discharge and the recharge characteristic of the battery. Thus there is good assurance of fully recharging the battery within 12 hours, avoiding a premature shutdown with its own attendant risk.

If established battery terminal float voltage cannot be restored to greater than or equal to the minimum established float voltage within 2 hours, and the charger is not operating in the current-limiting mode, a faulty charger is indicated. A faulty charger that is incapable of maintaining established battery terminal float voltage does not provide assurance that it can revert to and operate properly in the current limit mode that is necessary during the recovery period following a battery discharge event that the DC system is designed for.

If the charger is operating in the current limit mode after 2 hours, that is an indication that the battery is partially discharged and its capacity margins will be reduced. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action A.3).

BASES

ACTIONS (continued)

Required Action A.3 requires that the battery float current be verified as less than or equal to 3 amps. This indicates that, if the battery had been discharged as the result of the inoperable battery charger, it has now been fully recharged. If at the expiration of the initial 12 hour period the battery float current is not less than or equal to 3 amps this indicates there may be additional battery problems and the battery must be declared inoperable.

Required Action A.4 limits the restoration time for the inoperable battery charger to 7 days. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., balance of plant non-Class 1E battery charger). The 7 day Completion Time reflects a reasonable time to effect restoration of the qualified battery charger to operable status.

B.1

Condition B addresses the situation of crosstieing the operating unit's DC bus to the opposite unit, which has an inoperable battery charger, when the opposite unit is operating in MODE 1, 2, 3, or 4. This provision is included to accommodate unexpected failures, maintenance, and/or testing of the opposite unit's DC subsystems. The Completion Time for Required Action B.1 of 204 hours is adequate to allow testing and restoration activities. In this Condition, the opposite unit's battery is assumed to remain OPERABLE. Therefore, the function of the crosstie is to maintain the opposite unit's battery fully charged and to supply the minimal opposite unit DC loads. The 204 hours is based on the 7 days the opposite unit has to restore the inoperable charger and the 36 hours the opposite unit would have to reach MODE 5, if the charger is not restored to OPERABLE status. When the opposite unit reaches MODE 5, Condition C is entered. Requiring the associated crosstie breaker to be opened within 204 hours also ensures that independence of the DC subsystems is reestablished.

BASES

ACTIONS (continued)

C.1 and C.2

Condition C addresses an operating unit's DC bus that is crosstied to the opposite unit's associated DC bus, which has an inoperable source (i.e., battery or battery charger), when the opposite unit is shutdown. This provision is included to accommodate maintenance and/or testing of the shutdown unit's DC subsystems.

With the shutdown unit's battery inoperable, the operating unit will be required to supply all loads on the shutdown unit's crosstied bus should an event occur on the shutdown unit. Therefore, Required Action C.1 specifies that the possible loading on the shutdown unit's DC bus be verified to be ≤ 200 amps once per 12 hours. Limiting the load to 200 amps, ensures that the operating unit's DC subsystem will not be overloaded in the event of a concurrent event on the operating unit. Required Action C.1 is modified by a Note only requiring Required Action C.1 when the opposite unit has an inoperable battery.

Required Action C.2 requires the associated crosstie breaker to be opened within 7 days and ensures that measures are being taken to restore the inoperable battery or battery charger and reestablish independence of the DC subsystems.

D.1

Condition D represents one division with a loss of ability to completely respond to an event, and a potential loss of ability for the DC division to remain energized during normal operation. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected division. The 2 hour limit is consistent with the allowed time for an inoperable DC distribution system division.

BASES

ACTIONS (continued)

If one of the required DC electrical power subsystems is inoperable for reasons other than Condition A, B, or C (e.g., inoperable battery or one DC division crosstied to the opposite-unit DC division that does not have an inoperable battery charger), the remaining DC electrical power subsystem has the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could, however, result in the minimum necessary DC electrical power subsystems to mitigate a worst case accident, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. 7) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

E.1 and E.2

If the inoperable DC electrical power subsystem cannot be restored to OPERABLE status, or the crosstie breaker(s) cannot be opened, within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 7).

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge helps to ensure the effectiveness of the battery chargers, which support the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the connected loads and the continuous charge required to overcome the internal losses of a battery and maintain the battery in a fully charged state, while supplying the continuous steady state loads of the associated DC subsystem. On float charge, battery cells will receive adequate current to optimally charge the battery. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the minimum float voltage established by the battery manufacturer (2.20 Vpc or 127.6 volts at the battery terminals). This voltage maintains the battery plates in a condition that supports maintaining the grid life (expected to be approximately 20 years). The 7 day Frequency is consistent with manufacturer recommendations and IEEE-450 (Ref. 8).

SR 3.8.4.2

This SR verifies the design capacity of the battery chargers. According to Regulatory Guide 1.32 (Ref. 9), the battery charger output capacity is recommended to be based on the largest combined demands of the various steady state loads and the charging demands to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

This SR provides two options. One option requires that each battery charger be capable of supplying 400 amps at the minimum established float voltage for 8 hours. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time period is sufficient for the charger temperature to have stabilized and to have been maintained for at least 2 hours.

BASES

SURVEILLANCE REQUIREMENTS (continued)

The other option requires that each battery charger be capable of recharging the battery after a service test coincident with supplying the largest coincident demands of the various continuous steady state loads (irrespective of the status of the plant during which these demands occur). This level of loading may not normally be available following the battery service test and will need to be supplemented with additional loads. The duration for this test may be longer than the charger sizing criteria since the battery recharge is affected by float voltage, temperature, and the exponential decay in charging current. The battery is recharged when the measured charging current is ≤ 3 amps.

The Surveillance Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these 18 month intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

This Surveillance is required to be performed during MODES 5 and 6 since it would require the DC electrical power subsystem to be inoperable during performance of the test.

SR 3.8.4.3

A battery service test is a special test of battery capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The discharge rate and test length should correspond to the design duty cycle requirements as specified in Reference 4.

The Surveillance Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.32 (Ref. 9) and Regulatory Guide 1.129 (Ref. 10), which state that the battery service test should be performed during refueling operations or at some other outage, with intervals between tests, not to exceed 18 months.

This SR is modified by two Notes. Note 1 allows the performance of a modified performance discharge test in lieu of a service test.

BASES

SURVEILLANCE REQUIREMENTS (continued)

The reason for Note 2 is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.
3. IEEE-308-1978.
4. UFSAR, Chapter 8.
5. UFSAR, Chapter 6.
6. UFSAR, Chapter 15.
7. Regulatory Guide 1.93, December 1974.
8. IEEE-450-1995.
9. Regulatory Guide 1.32, February 1977.
10. Regulatory Guide 1.129, December 1974.

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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources – Shutdown

BASES

BACKGROUND

A description of the DC sources is provided in the Bases for LCO 3.8.4, "DC Sources – Operating."

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident and transient analyses in the UFSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume that Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators, emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC subsystem is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY.

The OPERABILITY of the minimum DC electrical power sources during MODES 5 and 6 and during movement of irradiated fuel assemblies ensures that:

a. The unit can be maintained in the shutdown or refueling condition for extended periods;

b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and

c. Adequate DC electrical power is provided to mitigate events postulated during shutdown, such as a fuel handling accident.

BASES

APPLICABLE SAFETY ANALYSES (continued)

In general, when the unit is shut down, the Technical Specifications requirements ensure that the unit has the capability to mitigate the consequences of postulated accidents. However, assuming a single failure and concurrent loss of all offsite or all onsite power is not required. The rationale for this is based on the fact that many Design Basis Accidents (DBAs) that are analyzed in MODES 1, 2, 3, and 4 have no specific analyses in MODES 5 and 6. Worst case bounding events are deemed not credible in MODES 5 and 6 because the energy contained within the reactor pressure boundary, reactor coolant temperature and pressure, and the corresponding stresses result in the probabilities of occurrence being significantly reduced or eliminated, and in minimal consequences. These deviations from DBA analysis assumptions and design requirements during shutdown conditions are allowed by the LCO for required systems.

The shutdown Technical Specifications requirements are designed to ensure that the unit has the capability to mitigate the consequences of certain postulated accidents. Worst case DBAs which are analyzed for operating MODES are generally viewed not to be a significant concern during shutdown MODES due to the lower energies involved. The Technical Specifications therefore require a lesser complement of electrical equipment to be available during shutdown than is required during operating MODES. More recent work completed on the potential risks associated with shutdown, however, have found significant risk associated with certain shutdown evolutions. As a result, in addition to the requirements established in the Technical Specifications, the industry has adopted NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management," as an industry initiative to manage shutdown tasks and associated electrical support to maintain risk at an acceptable low level. This may require the availability of additional equipment beyond that required by the shutdown Technical Specifications.

The DC sources satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

BASES

LCO

The DC electrical power subsystem, the required subsystem consisting of its associated battery and battery charger and at least one of the associated crosstie breakers open to maintain independence between the units, and the corresponding control equipment, and interconnecting cabling within the division are required to be OPERABLE to support the required division of the distribution system. This ensures the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

LCO 3.8.5 is modified by a Note which allows the required DC electrical power subsystem to be crosstied to the opposite unit, when the opposite unit is in MODE 1, 2, 3, or 4 with an inoperable charger. No load restrictions are placed on the bus loading, when the required DC electrical power subsystem is crosstied.

APPLICABILITY

The DC electrical power sources required to be OPERABLE in MODES 5 and 6, and at all times during movement of irradiated fuel assemblies, provide assurance that:

a. Required features to provide adequate coolant inventory makeup are available for the irradiated fuel assemblies in the core;

b. Required features needed to mitigate a fuel handling accident are available;

c. Required features necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

The DC electrical power requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.4.

BASES

ACTIONS

LCO 3.0.3 is not applicable while in MODE 5 or 6. However, since irradiated fuel assembly movement can occur in MODE 1, 2, 3, or 4, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. If moving irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operations. Therefore, in either case, inability to suspend movement of irradiated fuel assemblies would not be sufficient reason to require a reactor shutdown.

A.1, A.2.1, A.2.2, A.2.3, A.2.4, and A.2.5

By allowing the option to declare required features inoperable with the associated DC power source(s) inoperable, appropriate restrictions will be implemented in accordance with the affected required features' LCO ACTIONS. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, operations involving positive reactivity additions, and declare the affected Low Temperature Overpressure Protection (LTOP) features, required by LCO 3.4.12, inoperable). The Required Action to declare the associated LTOP features inoperable allows the operator to evaluate the current unit conditions and to determine which (if any) of the LTOP features have been affected by the loss of power. The Required Action to suspend positive reactivity additions does not preclude actions to maintain or increase reactor vessel inventory, provided the required SDM is maintained. Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. These actions minimize probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required DC electrical power subsystem and to continue this action until restoration is accomplished in order to provide the necessary DC electrical power to the unit safety systems.

The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required DC electrical power subsystem should be completed as quickly as possible in order to minimize the time during which the unit safety systems may be without sufficient power.

BASES

ACTIONS (continued)

B.1 and B.2

Condition B addresses a shutdown unit's DC bus that is crosstied to the opposite unit's associated DC bus, which has an inoperable source, when the opposite unit is also shutdown. This provision is included to accommodate maintenance and/or testing of the opposite unit's DC subsystems.

With the opposite unit's battery inoperable, the unit-specific DC subsystem will be required to supply all loads on the opposite unit's crosstied bus should an event occur on the opposite unit. Therefore, Required Action B.1 specifies that the possible loading on the opposite unit's DC bus be verified to be ≤ 200 amps once per 12 hours. Limiting the load to 200 amps, ensures that the unit-specific DC subsystem will not be overloaded in the event of a concurrent event on the unit. Required Action B.1 is modified by a Note requiring Required Action B.1 when the opposite unit has an inoperable battery.

Required Action B.2 requires the associated crosstie breaker to be opened within 7 days ensures that measures are being taken to reestablish independence of the DC subsystems.

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires application of all Surveillances required by SR 3.8.4.1 through SR 3.8.4.3. Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

This SR is modified by a Note. The reason for the Note is to preclude requiring the OPERABLE DC sources from being discharged below their capability to provide the required power supply or otherwise rendered inoperable during the performance of SRs. It is the intent that these SRs must still be capable of being met, but actual performance is not required.

BASES

REFERENCES

1. UFSAR, Chapter 6.
2. UFSAR, Chapter 15.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery Parameters

BASES

BACKGROUND	This LCO delineates the limits on battery float current as well as electrolyte temperature, level, and float voltage for the DC power subsystem source batteries. A discussion of these batteries and their OPERABILITY requirements is provided in the Bases for LCO 3.8.4, "DC Sources – Operating," and LCO 3.8.5, "DC Sources – Shutdown." In addition to the limitations of this Specification, Specification 5.5.17, "Battery Monitoring and Maintenance Program," for monitoring various battery parameters is based on the recommendations of IEEE Standard 450, "IEEE Recommended Practice For Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications" (Ref. 1).
	The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 120 volts for a 58 cell battery (i.e., cell voltage of 2.065 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.065 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage 2.20 to 2.25 Vpc. This provides adequate over-potential which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.22 Vpc corresponds to a total float voltage output of 128.8 volts for a 58 cell battery as discussed in UFSAR, Chapter 8 (Ref. 2).
APPLICABLE SAFETY ANALYSES	The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 6 (Ref. 3) and Chapter 15 (Ref. 4), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators, emergency auxiliaries, and control and switching during all MODES of operation.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the plant. This includes maintaining at least one division of DC sources OPERABLE during accident conditions, in the event of:

a. An assumed loss of all offsite AC power or all onsite AC power; and

b. A worst case single failure.

Battery parameters satisfy the Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Battery parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA. Battery parameter limits are conservatively established, allowing continued DC electrical system function even with limits not met. Additional preventative maintenance, testing, and monitoring performed in accordance with the Battery Monitoring and Maintenance Program is conducted as specified in Specification 5.5.17.

APPLICABILITY

The battery parameters are required solely for the support of the associated DC electrical power subsystems. Therefore, battery parameter limits are only required when the DC power source is required to be OPERABLE. Refer to the Applicability discussion in Bases for LCO 3.8.4 and LCO 3.8.5.

BASES

ACTIONS

The ACTIONS Table is modified by a Note which indicates that separate Condition entry is allowed for each battery. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory actions for each affected battery. Complying with the Required Actions for one battery may allow for continued operation, and subsequent battery parameters out of limits are governed by separate Condition entry and application of associated Required Actions.

<u>A.1, A.2, and A.3</u>

With one or more cells in one battery < 2.07 volts, the battery cell is degraded. Within 2 hours verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage (SR 3.8.4.1) and of the overall battery state of charge by monitoring the battery float charge current (SR 3.8.6.1). This assures that there is still sufficient battery capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of one or more cells in one battery < 2.07 volts, and continued operation is permitted for a limited period up to 24 hours.

Since the Required Actions only specify "perform," a failure of SR 3.8.4.1 or SR 3.8.6.1 acceptance criteria does not result in this Required Action not met. However, if one of the SRs is failed the appropriate Condition(s), depending on the cause of the failures, is entered.

If SR 3.8.6.1 is failed when in Condition A, then there is not assurance that there is still sufficient battery capacity to perform the intended function and Condition F must be entered and the battery declared inoperable immediately.

BASES

ACTIONS (continued)

B.1 and B.2

One battery with float current > 3 amps indicates that a partial discharge of the battery capacity has occurred. This may be due to a temporary loss of a battery charger or possibly due to one or more battery cells in a low voltage condition reflecting some loss of capacity. Within 2 hours verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage. If the terminal voltage is found to be less than the minimum established float voltage there are two possibilities, the battery charger is inoperable or is operating in the current limit mode. Condition A addressed charger inoperability. If the charger is operating in the current limit mode after 2 hours that is an indication that the battery has been substantially discharged and likely cannot perform its required design functions. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action B.2). The battery must therefore be declared inoperable.

If the float voltage is found to be satisfactory but there are one or more battery cells with float voltage less than 2.07 volts, the associated "OR" statement in Condition F is applicable and the battery must be declared inoperable immediately. If float voltage is satisfactory and there are no cells less than 2.07 volts there is good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action B.2) from any discharge that might have occurred due to a temporary loss of the battery charger. A discharged battery with float voltage (the charger setpoint) across its terminals indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of the previous discharge and the recharge characteristic of the battery. Thus there is good assurance of fully recharging the battery within 12 hours, avoiding a premature shutdown with its own attendant risk.

BASES

ACTIONS (continued)

If the condition is due to one or more cells in a low voltage condition but still greater than 2.07 volts and float voltage is found to be satisfactory, this is not indication of a substantially discharged battery and 12 hours is a reasonable time prior to declaring the battery inoperable.

Since Required Action B.1 only specifies "perform," a failure of SR 3.8.4.1 acceptance criteria does not result in the Required Action not met. However, if SR 3.8.4.1 is failed, the appropriate Condition(s), depending on the cause of the failure, is entered.

C.1, C.2, and C.3

With one battery with one or more cells electrolyte level above the top of the plates, but below the minimum established design limits, the battery still retains sufficient capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of electrolyte level not met. Within 31 days the minimum established design limits for electrolyte level must be re-established.

With electrolyte level below the top of the plates there is a potential for dryout and plate degradation. Required Actions C.1 and C.2 address this potential (as well as provisions in Specification 5.5.17). They are modified by a note that indicates they are only applicable if electrolyte level is below the top of the plates. Within 8 hours level is required to be restored to above the top of the plates. The Required Action C.2 requirement to verify that there is no leakage by visual inspection and the Specification 5.5.17 item b to initiate action to equalize and test in accordance with manufacturer's recommendation are taken from Annex D of IEEE Standard 450 (Ref. 1). They are performed following the restoration of the electrolyte level to above the top of the plates. Based on the results of the manufacturer's recommended testing the battery may have to be declared inoperable and the affected cell(s) replaced.

BASES

ACTIONS (continued)

D.1

With one battery with pilot cell temperature less than the minimum established design limits, 12 hours is allowed to restore the temperature to within limits. A low electrolyte temperature limits the current and power available. Since the battery is sized with margin, while battery capacity is degraded, sufficient capacity exists to perform the intended function and the affected battery is not required to be considered inoperable solely as a result of the pilot cell temperature not met.

E.1

With two batteries with battery parameters not within limits there is not sufficient assurance that battery capacity has not been affected to the degree that the batteries can still perform their required function, given that redundant batteries are involved. With redundant batteries involved this potential could result in a total loss of function on multiple systems that rely upon the batteries.

F.1

With one or more batteries with any battery parameter outside the allowances of the Required Actions for Condition A, B, C, D, or E, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC battery must be declared inoperable. Additionally, discovering one battery with one or more battery cells float voltage less than 2.07 volts and float current greater than 3 amps indicates that the battery capacity may not be sufficient to perform the intended functions. The battery must therefore be declared inoperable immediately.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.1

Verifying battery float current while on float charge is used to determine the state of charge of the battery. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery and maintain the battery in a charged state. The float current requirements are based on the float current indicative of a charged battery. Use of float current to determine the state of charge of the battery is consistent with IEEE-450 (Ref. 1). The 7 day Frequency is consistent with IEEE-450 (Ref. 1).

This SR is modified by a Note that states the float current requirement is not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. When this float voltage is not maintained the Required Actions of LCO 3.8.4 Action A are being taken, which provide the necessary and appropriate verifications of the battery condition. Furthermore, the float current limit of 3 amps is established based on the nominal float voltage value and is not directly applicable when this voltage is not maintained.

SR 3.8.6.2 and SR 3.8.6.5

Optimal long term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established design limits provided by the battery manufacturer, which corresponds to 127.6 volts at the battery terminals, or 2.20 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge, which could eventually render the battery inoperable. Float voltage in this range or less, but greater than 2.07 Vpc, are addressed in Specification 5.5.17. SRs 3.8.6.2 and 3.8.6.5 require verification that the cell float voltages are equal to or greater than the short term absolute minimum voltage of 2.07 volts. The Frequency for cell voltage verification every 31 days for pilot cell and 92 days for each connected cell is consistent with IEEE-450 (Ref. 1).

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.6.3

The limit specified for electrolyte level ensures that the plates suffer no physical damage and maintains adequate electron transfer capability. The Frequency is consistent with IEEE-450 (Ref. 1).

SR 3.8.6.4

This Surveillance verifies that the pilot cell temperature is greater than or equal to the minimum established design limit (i.e., 60°F). Pilot cell electrolyte temperature is maintained above this temperature to assure the battery can provide the required current and voltage to meet the design requirements. Temperatures lower than assumed in battery sizing calculations act to inhibit or reduce battery capacity. The Frequency is consistent with IEEE-450 (Ref. 1).

SR 3.8.6.6

A battery performance discharge test is a test of constant current capacity of a battery, normally done in the as found condition, after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.

Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.6.6, however, only the modified performance discharge test may be used to satisfy the battery service test requirements of SR 3.8.4.3.

A modified performance discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). This will often confirm the battery's ability to meet the critical period of the load duty cycle, in addition to determining its percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test and the test discharge rate must envelop the duty cycle of the service test if the modified performance discharge test is performed in lieu of a service test.

BASES

SURVEILLANCE REQUIREMENTS (continued)

It may consist of just two rates; for instance the one minute rate published for the battery or the largest current load of the duty cycle, followed by the test rate employed for the performance test, both of which envelop the duty cycle of the service test. Since the ampere-hours removed by a one minute discharge represents a very small portion of the battery capacity, the test rate can be changed to that for the performance test without compromising the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test must remain above the minimum battery terminal voltage specified in the battery service test for the duration of time equal to that of the service test.

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. 1) and IEEE-485 (Ref. 5). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. Furthermore, the battery is sized to meet the assumed duty cycle loads when the battery design capacity reaches this 80% limit.

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 1), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is > 10% below the manufacturer's rating. These Frequencies are consistent with the recommendations in IEEE-450 (Ref. 1).

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems.

BASES

REFERENCES

1. IEEE-450-1995.
2. UFSAR, Chapter 8.
3. UFSAR, Chapter 6.
4. UFSAR, Chapter 15.
5. IEEE-485-1983, June 1983.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.8 Inverters – Shutdown

BASES

BACKGROUND	A description of the inverters is provided in the Bases for LCO 3.8.7, "Inverters – Operating."

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume Engineered Safety Feature systems are OPERABLE. The DC to AC inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the Reactor Protective System and Engineered Safety Features Actuation System instrumentation and controls so that the fuel, Reactor Coolant System, and containment design limits are not exceeded.

The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY.

The OPERABILITY of the inverter to each required AC instrument bus during MODES 5 and 6 ensures that:

a. The unit can be maintained in the shutdown or refueling condition for extended periods;

b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and

c. Adequate power is available to mitigate events postulated during shutdown, such as a fuel handling accident.

BASES

APPLICABLE SAFETY ANALYSES (continued)

In general, when the unit is shut down, the Technical Specifications requirements ensure that the unit has the capability to mitigate the consequences of postulated accidents. However, assuming a single failure and concurrent loss of all offsite or all onsite power is not required. The rationale for this is based on the fact that many Design Basis Accidents (DBAs) that are analyzed in MODES 1, 2, 3, and 4 have no specific analyses in MODES 5 and 6. Worst case bounding events are deemed not credible in MODES 5 and 6 because the energy contained within the reactor pressure boundary, reactor coolant temperature and pressure, and the corresponding stresses result in the probabilities of occurrence being significantly reduced or eliminated, and in minimal consequences. These deviations from DBA analysis assumptions and design requirements during shutdown conditions are allowed by the LCO for required systems.

The shutdown Technical Specifications requirements are designed to ensure that the unit has the capability to mitigate the consequences of certain postulated accidents. Worst case DBAs which are analyzed for operating MODES are generally viewed not to be a significant concern during shutdown MODES due to the lower energies involved. The Technical Specifications therefore require a lesser complement of electrical equipment to be available during shutdown than is required during operating MODES. More recent work completed on the potential risks associated with shutdown, however, have found significant risk associated with certain shutdown evolutions. As a result, in addition to the requirements established in the Technical Specifications, the industry has adopted NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management," as an industry initiative to manage shutdown tasks and associated electrical support to maintain risk at an acceptable low level. This may require the availability of additional equipment beyond that required by the shutdown Technical Specifications.

The inverters were previously identified as part of the distribution system and, as such, satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

BASES

LCO

The inverters ensure the availability of electrical power for the instrumentation for systems required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA. One AC instrument bus division energized by two battery powered inverters provides uninterruptible supply of AC electrical power to at least one AC instrument bus division even if the 4.16 kV safety buses are de-energized. OPERABILITY of these two inverters requires that the associated AC instrument buses be powered by the inverters. This ensures the availability of sufficient inverter power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

APPLICABILITY

The inverters required to be OPERABLE in MODES 5 and 6, and at all times during movement of irradiated fuel assemblies, provide assurance that:

a. Systems to provide adequate coolant inventory makeup are available for the irradiated fuel in the core;

b. Systems needed to mitigate a fuel handling accident are available;

c. Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

Inverter requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.7.

BASES

ACTIONS

LCO 3.0.3 is not applicable while in MODE 5 or 6. However, since irradiated fuel assembly movement can occur in MODE 1, 2, 3, or 4, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. If moving irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operations. Therefore, in either case, inability to suspend movement of irradiated fuel assemblies would not be sufficient reason to require a reactor shutdown.

A.1, A.2.1, A.2.2, A.2.3, A.2.4, and A.2.5

By the allowance of the option to declare required features inoperable with the associated inverter(s) inoperable, appropriate restrictions will be implemented in accordance with the affected required features LCOs' Required Actions. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, operations involving positive reactivity additions, and declare the associated Low Temperature Overpressure Protection (LTOP) features inoperable). The Required Action to declare the associated LTOP features inoperable allows the operator to evaluate the current unit conditions and to determine which (if any) of the LTOP features have been affected by the loss of power. If the LTOP features have not been affected, then unnecessarily restrictive actions may be averted. The Required Action to suspend positive reactivity additions does not preclude actions to maintain or increase reactor vessel inventory, provided the required SDM is maintained. Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. These actions minimize the probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required inverters and to continue this action until restoration is accomplished in order to provide the necessary inverter power to the unit safety systems.

The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required inverters should be completed as quickly as possible in order to minimize the time the unit safety systems may be without power.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.8.1

This Surveillance verifies that the inverters are functioning properly with all required circuit breakers closed and required AC instrument buses energized. The verification of proper voltage output ensures that the required power is readily available for the instrumentation connected to the AC instrument buses. The 7 day Frequency takes into account the reliability of the instrument bus power sources and other indications available in the control room that alert the operator to malfunctions.

REFERENCES

1. UFSAR, Chapter 6.
2. UFSAR, Chapter 15.

BASES

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ATTACHMENT B-4

INCORPORATED TS BASES CHANGES FOR BYRON STATION, UNITS 1 AND 2 FOR INFORMATION ONLY

INCORPORATED TS BASES PAGES

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources – Operating

BASES

BACKGROUND

The station DC electrical power system provides the AC emergency power system with control power. It also provides both motive and control power to selected safety related equipment and AC instrument bus power (via inverters). As required by 10 CFR 50, Appendix A, GDC 17 (Ref. 1), the DC electrical power system is designed to have sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure. The DC electrical power system also conforms to the recommendations of Regulatory Guide 1.6 (Ref. 2) and IEEE-308 (Ref. 3).

The 125 VDC electrical power system for each unit consists of two independent and redundant safety related Class 1E DC electrical power subsystems (Division 11 (21) and Division 12 (22)). Each subsystem consists of one 125 VDC battery, the associated battery charger for each battery, and all the associated control equipment and interconnecting cabling.

During normal operation, the 125 VDC loads are powered from the battery chargers with the batteries floating on the system. In case of a loss of normal power to the battery charger, the DC load is automatically powered from the station battery.

The Division 11 (21) and Division 12 (22) DC electrical power subsystems provide the control power for its associated Class 1E AC power load group, 4.16 kV switchgear, and 480 V load centers. The DC electrical power subsystems also provide DC electrical power to the inverters, which in turn power the AC instrument buses. Additionally, the Class 1E 125 VDC electrical power subsystems provide power to the 6.9 kV Reactor Coolant Pump (RCP) breakers and the non-Class 1E 125 VDC buses. The connection between the Class 1E and non-Class 1E 125 VDC buses contains fuses to ensure that a fault on the non-Class 1E bus does not cause a loss of the Class 1E bus.

BASES

BACKGROUND (continued)

The DC power distribution system is described in more detail in Bases for LCO 3.8.9, "Distribution System – Operating," and LCO 3.8.10, "Distribution Systems – Shutdown."

Each 125 VDC battery is separately housed in a ventilated room apart from its charger and distribution centers. Each subsystem is located in an area separated physically and electrically from the other subsystem to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems, such as batteries, battery chargers, or distribution panels. While it is possible to interconnect the Unit 1 and Unit 2 DC electrical power subsystems, they normally remain disconnected, except when a DC source must be taken out of service for the purposes of maintenance and/or testing, or in the event of a failure of a DC source.

The crosstie between 125 VDC ESF buses 111 and 211 and the crosstie between 125 VDC ESF buses 112 and 212 are each provided with two normally locked open, manually operated circuit breakers. No interlocks are provided since the interconnected buses are not redundant. However, if one battery is inoperable, procedural and administrative controls are used to limit the connected load to 200 amps based on not exceeding the OPERABLE battery capacity. These controls ensure that combinations of maintenance and test operations will not preclude the system capabilities to supply power to the ESF DC loads. The provisions of administratively controlled, manually actuated, interconnections between the non-redundant Class 1E DC buses increases the overall reliability and availability of the DC systems for each unit in that it provides a means for manually providing power to a DC bus at a time when it would otherwise have to be out-of-service (e.g., to perform a battery discharge test during an outage, to replace a damaged cell, etc.). Crosstie breaker closed alarms are also provided to alert the operator when the units are crosstied.

BASES

BACKGROUND (continued)

Each battery has adequate storage capacity to meet the duty cycle(s) discussed in UFSAR, Chapter 8 (Ref. 4). The battery is designed with additional capacity above that required by the design duty cycle to allow for temperature variations and other factors.

The Division 11 (21) and Division 12 (22) DC electrical power subsystem batteries are sized to produce required capacity at 80% of nameplate rating, corresponding to warranted capacity at end of life cycles and the 100% design demand. The minimum design voltage limit is 108 volts.

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 120 volts for a 58 cell battery (i.e., cell voltage of 2.065 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.065 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage 2.20 to 2.25 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.22 Vpc corresponds to a total float voltage output of 128.8 volts for a 58 cell battery as discussed in UFSAR, Chapter 8 (Ref. 4).

Each Division 11 (21) and Division 12 (22) DC electrical power subsystem battery charger has ample power output capacity for the steady state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged. Each battery charger also has sufficient excess capacity to restore the battery from the design minimum charge to its fully charged state within 24 hours while supplying normal steady state loads discussed in the UFSAR, Chapter 8 (Ref. 4).

The battery charger is normally in the float-charge mode. Float-charge is the condition in which the charger is supplying the connected loads and the battery cells are receiving adequate current to optimally charge the battery. This assures the internal losses of a battery are overcome and the battery is maintained in a fully charged state.

BASES

BACKGROUND (continued)

When desired, the charger can be placed in the equalize mode. The equalize mode is at a higher voltage than the float mode and charging current is correspondingly higher. The battery charger is operated in the equalize mode after a battery discharge or for routine maintenance. Following a battery discharge, the battery recharge characteristic accepts current at the current limit of the battery charger if the discharge was significant, e.g., following a battery service test, until the battery terminal voltage approaches the charger voltage setpoint. Charging current then reduces exponentially during the remainder of the recharge cycle. Lead-calcium batteries have recharge efficiencies of greater than 95%, so once at least 105% of the ampere-hours discharged have been returned, the battery capacity would be restored to the same condition as it was prior to the discharge. This can be monitored by direct observation of the exponentially decaying charging current or by evaluating the amp-hours discharged from the battery and amp-hours returned to the battery.

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 6 (Ref. 5), and in the UFSAR, Chapter 15 (Ref. 6), assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the DGs, emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC sources is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the plant. This includes maintaining the DC electrical power distribution subsystem OPERABLE during accident conditions in the event of:

a. An assumed loss of all offsite AC power or all onsite AC power sources; and

b. A worst case single failure.

The DC sources satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

BASES

LCO

The DC electrical power subsystems, each subsystem consisting of:

a. a battery;

b. battery charger; and

c. the corresponding control equipment and interconnecting cabling supplying power to the associated bus within the division,

are required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an Anticipated Operational Occurrence (AOO) or a postulated DBA. Loss of any division DC electrical power subsystem does not prevent the minimum safety function from being performed (Ref. 4). Furthermore, at least one crosstie breaker between Division 11 and Division 21, and at least one crosstie breaker between Division 12 and Division 22, is required to be open to maintain independence between the units.

An OPERABLE DC electrical power subsystem requires the required battery and respective charger to be operating and connected to the associated DC bus.

APPLICABILITY

The DC electrical power sources are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure safe unit operation and to ensure that:

a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and

b. Adequate core cooling is provided, and containment integrity and other vital functions are maintained in the event of a postulated DBA.

The DC electrical power requirements for MODES 5 and 6 are addressed in LCO 3.8.5, "DC Sources – Shutdown."

ACTIONS

A.1, A.2, A.3 and A.4

Condition A addresses the event of having one battery charger inoperable (e.g., the voltage limit of SR 3.8.4.1 is not maintained). The ACTIONS provide a tiered response that focuses on returning the battery to the fully charged state and restoring a fully qualified charger to OPERABLE status in a reasonable time period.

Required Action A.1 provides for restoration of electrical power to the associated DC bus by use of the crosstie capability to the opposite unit. The 2 hour Completion Time allows adequate time to evaluate the cause for battery charger failure, to determine whether the opposite unit's DC bus is available for support, and to perform the crosstie procedure. The battery charger is required to be restored to OPERABLE status within 7 days in order to reestablish the independence of DC subsystems, while providing a reasonable amount of time for repairs. By limiting the crosstied conditions of operating units to 7 days, the likelihood of an event occurring which could place either unit in jeopardy is minimized. (Note, there are no load restrictions applicable to the opposite unit's DC bus in this condition.)

BASES

ACTIONS (continued)

Required Action A.2 requires that the battery terminal voltage be restored to greater than or equal to the minimum established float voltage within 2 hours. This time provides for returning the inoperable charger to OPERABLE status or providing an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage. Restoring the battery terminal voltage to greater than or equal to the minimum established float voltage provides good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action A.3) from any discharge that might have occurred due to the charger inoperability. A discharged battery having terminal voltage of at least the minimum established float voltage indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of the previous discharge and the recharge characteristic of the battery. Thus there is good assurance of fully recharging the battery within 12 hours, avoiding a premature shutdown with its own attendant risk.

If established battery terminal float voltage cannot be restored to greater than or equal to the minimum established float voltage within 2 hours, and the charger is not operating in the current-limiting mode, a faulty charger is indicated. A faulty charger that is incapable of maintaining established battery terminal float voltage does not provide assurance that it can revert to and operate properly in the current limit mode that is necessary during the recovery period following a battery discharge event that the DC system is designed for.

If the charger is operating in the current limit mode after 2 hours, that is an indication that the battery is partially discharged and its capacity margins will be reduced. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action A.3).

BASES

ACTIONS (continued)

Required Action A.3 requires that the battery float current be verified as less than or equal to 3 amps. This indicates that, if the battery had been discharged as the result of the inoperable battery charger, it has now been fully recharged. If at the expiration of the initial 12 hour period the battery float current is not less than or equal to 3 amps this indicates there may be additional battery problems and the battery must be declared inoperable.

Required Action A.4 limits the restoration time for the inoperable battery charger to 7 days. This action is applicable if an alternate means of restoring battery terminal voltage to greater than or equal to the minimum established float voltage has been used (e.g., balance of plant non-Class 1E battery charger). The 7 day Completion Time reflects a reasonable time to effect restoration of the qualified battery charger to operable status.

B.1

Condition B addresses the situation of crosstieing the operating unit's DC bus to the opposite unit, which has an inoperable battery charger, when the opposite unit is operating in MODE 1, 2, 3, or 4. This provision is included to accommodate unexpected failures, maintenance, and/or testing of the opposite unit's DC subsystems. The Completion Time for Required Action B.1 of 204 hours is adequate to allow testing and restoration activities. In this Condition, the opposite unit's battery is assumed to remain OPERABLE. Therefore, the function of the crosstie is to maintain the opposite unit's battery fully charged and to supply the minimal opposite unit DC loads. The 204 hours is based on the 7 days the opposite unit has to restore the inoperable charger and the 36 hours the opposite unit would have to reach MODE 5, if the charger is not restored to OPERABLE status. When the opposite unit reaches MODE 5, Condition C is entered. Requiring the associated crosstie breaker to be opened within 204 hours also ensures that independence of the DC subsystems is reestablished.

BASES

ACTIONS (continued)

C.1 and C.2

Condition C addresses an operating unit's DC bus that is crosstied to the opposite unit's associated DC bus, which has an inoperable source (i.e., battery or battery charger), when the opposite unit is shutdown. This provision is included to accommodate maintenance and/or testing of the shutdown unit's DC subsystems.

With the shutdown unit's battery inoperable, the operating unit will be required to supply all loads on the shutdown unit's crosstied bus should an event occur on the shutdown unit. Therefore, Required Action C.1 specifies that the possible loading on the shutdown unit's DC bus be verified to be ≤ 200 amps once per 12 hours. Limiting the load to 200 amps, ensures that the operating unit's DC subsystem will not be overloaded in the event of a concurrent event on the operating unit. Required Action C.1 is modified by a Note only requiring Required Action C.1 when the opposite unit has an inoperable battery.

Required Action C.2 requires the associated crosstie breaker to be opened within 7 days and ensures that measures are being taken to restore the inoperable battery or battery charger and reestablish independence of the DC subsystems.

D.1

Condition D represents one division with a loss of ability to completely respond to an event, and a potential loss of ability for the DC division to remain energized during normal operation. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected division. The 2 hour limit is consistent with the allowed time for an inoperable DC distribution system division.

BASES

ACTIONS (continued)

If one of the required DC electrical power subsystems is inoperable for reasons other than Condition A, B, or C (e.g., inoperable battery or one DC division crosstied to the opposite-unit DC division that does not have an inoperable battery charger), the remaining DC electrical power subsystem has the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure could, however, result in the minimum necessary DC electrical power subsystems to mitigate a worst case accident, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. 7) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

E.1 and E.2

If the inoperable DC electrical power subsystem cannot be restored to OPERABLE status, or the crosstie breaker(s) cannot be opened, within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 7).

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge helps to ensure the effectiveness of the battery chargers, which support the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the connected loads and the continuous charge required to overcome the internal losses of a battery and maintain the battery in a fully charged state, while supplying the continuous steady state loads of the associated DC subsystem. On float charge, battery cells will receive adequate current to optimally charge the battery. The voltage requirements are based on the nominal design voltage of the battery and are consistent with the minimum float voltage established by the battery manufacturer (2.20 Vpc or 127.6 volts at the battery terminals). This voltage maintains the battery plates in a condition that supports maintaining the grid life (expected to be approximately 20 years). The 7 day Frequency is consistent with manufacturer recommendations and IEEE-450 (Ref. 8).

SR 3.8.4.2

This SR verifies the design capacity of the battery chargers. According to Regulatory Guide 1.32 (Ref. 9), the battery charger output capacity is recommended to be based on the largest combined demands of the various steady state loads and the charging demands to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

This SR provides two options. One option requires that each battery charger be capable of supplying 400 amps at the minimum established float voltage for 8 hours. The ampere requirements are based on the output rating of the chargers. The voltage requirements are based on the charger voltage level after a response to a loss of AC power. The time period is sufficient for the charger temperature to have stabilized and to have been maintained for at least 2 hours.

BASES

SURVEILLANCE REQUIREMENTS (continued)

The other option requires that each battery charger be capable of recharging the battery after a service test coincident with supplying the largest coincident demands of the various continuous steady state loads (irrespective of the status of the plant during which these demands occur). This level of loading may not normally be available following the battery service test and will need to be supplemented with additional loads. The duration for this test may be longer than the charger sizing criteria since the battery recharge is affected by float voltage, temperature, and the exponential decay in charging current. The battery is recharged when the measured charging current is ≤ 3 amps.

The Surveillance Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these 18 month intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

This Surveillance is required to be performed during MODES 5 and 6 since it would require the DC electrical power subsystem to be inoperable during performance of the test.

SR 3.8.4.3

A battery service test is a special test of battery capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The discharge rate and test length should correspond to the design duty cycle requirements as specified in Reference 4.

The Surveillance Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.32 (Ref. 9) and Regulatory Guide 1.129 (Ref. 10), which state that the battery service test should be performed during refueling operations or at some other outage, with intervals between tests, not to exceed 18 months.

This SR is modified by two Notes. Note 1 allows the performance of a modified performance discharge test in lieu of a service test.

BASES

SURVEILLANCE REQUIREMENTS (continued)

The reason for Note 2 is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.
3. IEEE-308-1978.
4. UFSAR, Chapter 8.
5. UFSAR, Chapter 6.
6. UFSAR, Chapter 15.
7. Regulatory Guide 1.93, December 1974.
8. IEEE-450-1995.
9. Regulatory Guide 1.32, February 1977.
10. Regulatory Guide 1.129, December 1974.

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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources – Shutdown

BASES

BACKGROUND

A description of the DC sources is provided in the Bases for LCO 3.8.4, "DC Sources – Operating."

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident and transient analyses in the UFSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume that Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators, emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC subsystem is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY.

The OPERABILITY of the minimum DC electrical power sources during MODES 5 and 6 and during movement of irradiated fuel assemblies ensures that:

a. The unit can be maintained in the shutdown or refueling condition for extended periods;

b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and

c. Adequate DC electrical power is provided to mitigate events postulated during shutdown, such as a fuel handling accident.

BASES

APPLICABLE SAFETY ANALYSES (continued)

In general, when the unit is shut down, the Technical Specifications requirements ensure that the unit has the capability to mitigate the consequences of postulated accidents. However, assuming a single failure and concurrent loss of all offsite or all onsite power is not required. The rationale for this is based on the fact that many Design Basis Accidents (DBAs) that are analyzed in MODES 1, 2, 3, and 4 have no specific analyses in MODES 5 and 6. Worst case bounding events are deemed not credible in MODES 5 and 6 because the energy contained within the reactor pressure boundary, reactor coolant temperature and pressure, and the corresponding stresses result in the probabilities of occurrence being significantly reduced or eliminated, and in minimal consequences. These deviations from DBA analysis assumptions and design requirements during shutdown conditions are allowed by the LCO for required systems.

The shutdown Technical Specifications requirements are designed to ensure that the unit has the capability to mitigate the consequences of certain postulated accidents. Worst case DBAs which are analyzed for operating MODES are generally viewed not to be a significant concern during shutdown MODES due to the lower energies involved. The Technical Specifications therefore require a lesser complement of electrical equipment to be available during shutdown than is required during operating MODES. More recent work completed on the potential risks associated with shutdown, however, have found significant risk associated with certain shutdown evolutions. As a result, in addition to the requirements established in the Technical Specifications, the industry has adopted NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management," as an industry initiative to manage shutdown tasks and associated electrical support to maintain risk at an acceptable low level. This may require the availability of additional equipment beyond that required by the shutdown Technical Specifications.

The DC sources satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

BASES

LCO

The DC electrical power subsystem, the required subsystem consisting of its associated battery and battery charger and at least one of the associated crosstie breakers open to maintain independence between the units, and the corresponding control equipment, and interconnecting cabling within the division are required to be OPERABLE to support the required division of the distribution system. This ensures the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

LCO 3.8.5 is modified by a Note which allows the required DC electrical power subsystem to be crosstied to the opposite unit, when the opposite unit is in MODE 1, 2, 3, or 4 with an inoperable charger. No load restrictions are placed on the bus loading, when the required DC electrical power subsystem is crosstied.

APPLICABILITY

The DC electrical power sources required to be OPERABLE in MODES 5 and 6, and at all times during movement of irradiated fuel assemblies, provide assurance that:

a. Required features to provide adequate coolant inventory makeup are available for the irradiated fuel assemblies in the core;

b. Required features needed to mitigate a fuel handling accident are available;

c. Required features necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

The DC electrical power requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.4.

BASES

ACTIONS

LCO 3.0.3 is not applicable while in MODE 5 or 6. However, since irradiated fuel assembly movement can occur in MODE 1, 2, 3, or 4, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. If moving irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operations. Therefore, in either case, inability to suspend movement of irradiated fuel assemblies would not be sufficient reason to require a reactor shutdown.

A.1, A.2.1, A.2.2, A.2.3, A.2.4, and A.2.5

By allowing the option to declare required features inoperable with the associated DC power source(s) inoperable, appropriate restrictions will be implemented in accordance with the affected required features' LCO ACTIONS. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, operations involving positive reactivity additions, and declare the affected Low Temperature Overpressure Protection (LTOP) features, required by LCO 3.4.12, inoperable). The Required Action to declare the associated LTOP features inoperable allows the operator to evaluate the current unit conditions and to determine which (if any) of the LTOP features have been affected by the loss of power. The Required Action to suspend positive reactivity additions does not preclude actions to maintain or increase reactor vessel inventory, provided the required SDM is maintained. Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. These actions minimize probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required DC electrical power subsystem and to continue this action until restoration is accomplished in order to provide the necessary DC electrical power to the unit safety systems.

The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required DC electrical power subsystem should be completed as quickly as possible in order to minimize the time during which the unit safety systems may be without sufficient power.

BASES

ACTIONS (continued)

B.1 and B.2

Condition B addresses a shutdown unit's DC bus that is crosstied to the opposite unit's associated DC bus, which has an inoperable source, when the opposite unit is also shutdown. This provision is included to accommodate maintenance and/or testing of the opposite unit's DC subsystems.

With the opposite unit's battery inoperable, the unit-specific DC subsystem will be required to supply all loads on the opposite unit's crosstied bus should an event occur on the opposite unit. Therefore, Required Action B.1 specifies that the possible loading on the opposite unit's DC bus be verified to be ≤ 200 amps once per 12 hours. Limiting the load to 200 amps, ensures that the unit-specific DC subsystem will not be overloaded in the event of a concurrent event on the unit. Required Action B.1 is modified by a Note requiring Required Action B.1 when the opposite unit has an inoperable battery.

Required Action B.2 requires the associated crosstie breaker to be opened within 7 days ensures that measures are being taken to reestablish independence of the DC subsystems.

SURVEILLANCE REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires application of all Surveillances required by SR 3.8.4.1 through SR 3.8.4.3. Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

This SR is modified by a Note. The reason for the Note is to preclude requiring the OPERABLE DC sources from being discharged below their capability to provide the required power supply or otherwise rendered inoperable during the performance of SRs. It is the intent that these SRs must still be capable of being met, but actual performance is not required.

BASES

REFERENCES

1. UFSAR, Chapter 6.
2. UFSAR, Chapter 15.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery Parameters

BASES

BACKGROUND

This LCO delineates the limits on battery float current as well as electrolyte temperature, level, and float voltage for the DC power subsystem source batteries. A discussion of these batteries and their OPERABILITY requirements is provided in the Bases for LCO 3.8.4, "DC Sources – Operating," and LCO 3.8.5, "DC Sources – Shutdown." In addition to the limitations of this Specification, Specification 5.5.17, "Battery Monitoring and Maintenance Program," for monitoring various battery parameters is based on the recommendations of IEEE Standard 450, "IEEE Recommended Practice For Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications" (Ref. 1).

The battery cells are of flooded lead acid construction with a nominal specific gravity of 1.215. This specific gravity corresponds to an open circuit battery voltage of approximately 120 volts for a 58 cell battery (i.e., cell voltage of 2.065 volts per cell (Vpc)). The open circuit voltage is the voltage maintained when there is no charging or discharging. Once fully charged with its open circuit voltage ≥ 2.065 Vpc, the battery cell will maintain its capacity for 30 days without further charging per manufacturer's instructions. Optimal long term performance however, is obtained by maintaining a float voltage 2.20 to 2.25 Vpc. This provides adequate over-potential which limits the formation of lead sulfate and self discharge. The nominal float voltage of 2.22 Vpc corresponds to a total float voltage output of 128.8 volts for a 58 cell battery as discussed in UFSAR, Chapter 8 (Ref. 2).

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 6 (Ref. 3) and Chapter 15 (Ref. 4), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for the diesel generators, emergency auxiliaries, and control and switching during all MODES of operation.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the plant. This includes maintaining at least one division of DC sources OPERABLE during accident conditions, in the event of:

a. An assumed loss of all offsite AC power or all onsite AC power; and

b. A worst case single failure.

Battery parameters satisfy the Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Battery parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA. Battery parameter limits are conservatively established, allowing continued DC electrical system function even with limits not met. Additional preventative maintenance, testing, and monitoring performed in accordance with the Battery Monitoring and Maintenance Program is conducted as specified in Specification 5.5.17.

APPLICABILITY

The battery parameters are required solely for the support of the associated DC electrical power subsystems. Therefore, battery parameter limits are only required when the DC power source is required to be OPERABLE. Refer to the Applicability discussion in Bases for LCO 3.8.4 and LCO 3.8.5.

BASES

ACTIONS

The ACTIONS Table is modified by a Note which indicates that separate Condition entry is allowed for each battery. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory actions for each affected battery. Complying with the Required Actions for one battery may allow for continued operation, and subsequent battery parameters out of limits are governed by separate Condition entry and application of associated Required Actions.

A.1, A.2, and A.3

With one or more cells in one battery < 2.07 volts, the battery cell is degraded. Within 2 hours verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage (SR 3.8.4.1) and of the overall battery state of charge by monitoring the battery float charge current (SR 3.8.6.1). This assures that there is still sufficient battery capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of one or more cells in one battery < 2.07 volts, and continued operation is permitted for a limited period up to 24 hours.

Since the Required Actions only specify "perform," a failure of SR 3.8.4.1 or SR 3.8.6.1 acceptance criteria does not result in this Required Action not met. However, if one of the SRs is failed the appropriate Condition(s), depending on the cause of the failures, is entered.

If SR 3.8.6.1 is failed when in Condition A, then there is not assurance that there is still sufficient battery capacity to perform the intended function and Condition F must be entered and the battery declared inoperable immediately.

BASES

ACTIONS (continued)

B.1 and B.2

One battery with float current > 3 amps indicates that a partial discharge of the battery capacity has occurred. This may be due to a temporary loss of a battery charger or possibly due to one or more battery cells in a low voltage condition reflecting some loss of capacity. Within 2 hours verification of the required battery charger OPERABILITY is made by monitoring the battery terminal voltage. If the terminal voltage is found to be less than the minimum established float voltage there are two possibilities, the battery charger is inoperable or is operating in the current limit mode. Condition A addressed charger inoperability. If the charger is operating in the current limit mode after 2 hours that is an indication that the battery has been substantially discharged and likely cannot perform its required design functions. The time to return the battery to its fully charged condition in this case is a function of the battery charger capacity, the amount of loads on the associated DC system, the amount of the previous discharge, and the recharge characteristic of the battery. The charge time can be extensive, and there is not adequate assurance that it can be recharged within 12 hours (Required Action B.2). The battery must therefore be declared inoperable.

If the float voltage is found to be satisfactory but there are one or more battery cells with float voltage less than 2.07 volts, the associated "OR" statement in Condition F is applicable and the battery must be declared inoperable immediately. If float voltage is satisfactory and there are no cells less than 2.07 volts there is good assurance that, within 12 hours, the battery will be restored to its fully charged condition (Required Action B.2) from any discharge that might have occurred due to a temporary loss of the battery charger. A discharged battery with float voltage (the charger setpoint) across its terminals indicates that the battery is on the exponential charging current portion (the second part) of its recharge cycle. The time to return a battery to its fully charged state under this condition is simply a function of the amount of the previous discharge and the recharge characteristic of the battery. Thus there is good assurance of fully recharging the battery within 12 hours, avoiding a premature shutdown with its own attendant risk.

BASES

ACTIONS (continued)

If the condition is due to one or more cells in a low voltage condition but still greater than 2.07 volts and float voltage is found to be satisfactory, this is not indication of a substantially discharged battery and 12 hours is a reasonable time prior to declaring the battery inoperable.

Since Required Action B.1 only specifies "perform," a failure of SR 3.8.4.1 acceptance criteria does not result in the Required Action not met. However, if SR 3.8.4.1 is failed, the appropriate Condition(s), depending on the cause of the failure, is entered.

C.1, C.2, and C.3

With one battery with one or more cells electrolyte level above the top of the plates, but below the minimum established design limits, the battery still retains sufficient capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of electrolyte level not met. Within 31 days the minimum established design limits for electrolyte level must be re-established.

With electrolyte level below the top of the plates there is a potential for dryout and plate degradation. Required Actions C.1 and C.2 address this potential (as well as provisions in Specification 5.5.17). They are modified by a note that indicates they are only applicable if electrolyte level is below the top of the plates. Within 8 hours level is required to be restored to above the top of the plates. The Required Action C.2 requirement to verify that there is no leakage by visual inspection and the Specification 5.5.17 item b to initiate action to equalize and test in accordance with manufacturer's recommendation are taken from Annex D of IEEE Standard 450 (Ref. 1). They are performed following the restoration of the electrolyte level to above the top of the plates. Based on the results of the manufacturer's recommended testing the battery may have to be declared inoperable and the affected cell(s) replaced.

BASES

ACTIONS (continued)

D.1

With one battery with pilot cell temperature less than the minimum established design limits, 12 hours is allowed to restore the temperature to within limits. A low electrolyte temperature limits the current and power available. Since the battery is sized with margin, while battery capacity is degraded, sufficient capacity exists to perform the intended function and the affected battery is not required to be considered inoperable solely as a result of the pilot cell temperature not met.

E.1

With two batteries with battery parameters not within limits there is not sufficient assurance that battery capacity has not been affected to the degree that the batteries can still perform their required function, given that redundant batteries are involved. With redundant batteries involved this potential could result in a total loss of function on multiple systems that rely upon the batteries.

F.1

With one or more batteries with any battery parameter outside the allowances of the Required Actions for Condition A, B, C, D, or E, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC battery must be declared inoperable. Additionally, discovering one battery with one or more battery cells float voltage less than 2.07 volts and float current greater than 3 amps indicates that the battery capacity may not be sufficient to perform the intended functions. The battery must therefore be declared inoperable immediately.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.6.1

Verifying battery float current while on float charge is used to determine the state of charge of the battery. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery and maintain the battery in a charged state. The float current requirements are based on the float current indicative of a charged battery. Use of float current to determine the state of charge of the battery is consistent with IEEE-450 (Ref. 1). The 7 day Frequency is consistent with IEEE-450 (Ref. 1).

This SR is modified by a Note that states the float current requirement is not required to be met when battery terminal voltage is less than the minimum established float voltage of SR 3.8.4.1. When this float voltage is not maintained the Required Actions of LCO 3.8.4 Action A are being taken, which provide the necessary and appropriate verifications of the battery condition. Furthermore, the float current limit of 3 amps is established based on the nominal float voltage value and is not directly applicable when this voltage is not maintained.

SR 3.8.6.2 and SR 3.8.6.5

Optimal long term battery performance is obtained by maintaining a float voltage greater than or equal to the minimum established design limits provided by the battery manufacturer, which corresponds to 127.6 volts at the battery terminals, or 2.20 Vpc. This provides adequate over-potential, which limits the formation of lead sulfate and self discharge, which could eventually render the battery inoperable. Float voltage in this range or less, but greater than 2.07 Vpc, are addressed in Specification 5.5.17. SRs 3.8.6.2 and 3.8.6.5 require verification that the cell float voltages are equal to or greater than the short term absolute minimum voltage of 2.07 volts. The Frequency for cell voltage verification every 31 days for pilot cell and 92 days for each connected cell is consistent with IEEE-450 (Ref. 1).

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.6.3

The limit specified for electrolyte level ensures that the plates suffer no physical damage and maintains adequate electron transfer capability. The Frequency is consistent with IEEE-450 (Ref. 1).

SR 3.8.6.4

This Surveillance verifies that the pilot cell temperature is greater than or equal to the minimum established design limit (i.e., 60°F). Pilot cell electrolyte temperature is maintained above this temperature to assure the battery can provide the required current and voltage to meet the design requirements. Temperatures lower than assumed in battery sizing calculations act to inhibit or reduce battery capacity. The Frequency is consistent with IEEE-450 (Ref. 1).

SR 3.8.6.6

A battery performance discharge test is a test of constant current capacity of a battery, normally done in the as found condition, after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.

Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.6.6, however, only the modified performance discharge test may be used to satisfy the battery service test requirements of SR 3.8.4.3.

A modified performance discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). This will often confirm the battery's ability to meet the critical period of the load duty cycle, in addition to determining its percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test and the test discharge rate must envelop the duty cycle of the service test if the modified performance discharge test is performed in lieu of a service test.

BASES

SURVEILLANCE REQUIREMENTS (continued)

It may consist of just two rates; for instance the one minute rate published for the battery or the largest current load of the duty cycle, followed by the test rate employed for the performance test, both of which envelop the duty cycle of the service test. Since the ampere-hours removed by a one minute discharge represents a very small portion of the battery capacity, the test rate can be changed to that for the performance test without compromising the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test must remain above the minimum battery terminal voltage specified in the battery service test for the duration of time equal to that of the service test.

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. 1) and IEEE-485 (Ref. 5). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements. Furthermore, the battery is sized to meet the assumed duty cycle loads when the battery design capacity reaches this 80% limit.

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected life and capacity is < 100% of the manufacturer's rating, the Surveillance Frequency is reduced to 12 months. However, if the battery shows no degradation but has reached 85% of its expected life, the Surveillance Frequency is only reduced to 24 months for batteries that retain capacity ≥ 100% of the manufacturer's rating. Degradation is indicated, according to IEEE-450 (Ref. 1), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is > 10% below the manufacturer's rating. These Frequencies are consistent with the recommendations in IEEE-450 (Ref. 1).

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would perturb the electrical distribution system and challenge safety systems.

BASES

REFERENCES

1. IEEE-450-1995.
2. UFSAR, Chapter 8.
3. UFSAR, Chapter 6.
4. UFSAR, Chapter 15.
5. IEEE-485-1983, June 1983.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.8 Inverters – Shutdown

BASES

BACKGROUND

A description of the inverters is provided in the Bases for LCO 3.8.7, "Inverters – Operating."

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the UFSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume Engineered Safety Feature systems are OPERABLE. The DC to AC inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the Reactor Protective System and Engineered Safety Features Actuation System instrumentation and controls so that the fuel, Reactor Coolant System, and containment design limits are not exceeded.

The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY.

The OPERABILITY of the inverter to each required AC instrument bus during MODES 5 and 6 ensures that:

a. The unit can be maintained in the shutdown or refueling condition for extended periods;

b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and

c. Adequate power is available to mitigate events postulated during shutdown, such as a fuel handling accident.

BASES

APPLICABLE SAFETY ANALYSES (continued)

In general, when the unit is shut down, the Technical Specifications requirements ensure that the unit has the capability to mitigate the consequences of postulated accidents. However, assuming a single failure and concurrent loss of all offsite or all onsite power is not required. The rationale for this is based on the fact that many Design Basis Accidents (DBAs) that are analyzed in MODES 1, 2, 3, and 4 have no specific analyses in MODES 5 and 6. Worst case bounding events are deemed not credible in MODES 5 and 6 because the energy contained within the reactor pressure boundary, reactor coolant temperature and pressure, and the corresponding stresses result in the probabilities of occurrence being significantly reduced or eliminated, and in minimal consequences. These deviations from DBA analysis assumptions and design requirements during shutdown conditions are allowed by the LCO for required systems.

The shutdown Technical Specifications requirements are designed to ensure that the unit has the capability to mitigate the consequences of certain postulated accidents. Worst case DBAs which are analyzed for operating MODES are generally viewed not to be a significant concern during shutdown MODES due to the lower energies involved. The Technical Specifications therefore require a lesser complement of electrical equipment to be available during shutdown than is required during operating MODES. More recent work completed on the potential risks associated with shutdown, however, have found significant risk associated with certain shutdown evolutions. As a result, in addition to the requirements established in the Technical Specifications, the industry has adopted NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management," as an industry initiative to manage shutdown tasks and associated electrical support to maintain risk at an acceptable low level. This may require the availability of additional equipment beyond that required by the shutdown Technical Specifications.

The inverters were previously identified as part of the distribution system and, as such, satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

BASES

LCO

The inverters ensure the availability of electrical power for the instrumentation for systems required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA. One AC instrument bus division energized by two battery powered inverters provides uninterruptible supply of AC electrical power to at least one AC instrument bus division even if the 4.16 kV safety buses are de-energized. OPERABILITY of these two inverters requires that the associated AC instrument buses be powered by the inverters. This ensures the availability of sufficient inverter power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

APPLICABILITY

The inverters required to be OPERABLE in MODES 5 and 6, and at all times during movement of irradiated fuel assemblies, provide assurance that:

a. Systems to provide adequate coolant inventory makeup are available for the irradiated fuel in the core;

b. Systems needed to mitigate a fuel handling accident are available;

c. Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

Inverter requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.7.

BASES

ACTIONS

LCO 3.0.3 is not applicable while in MODE 5 or 6. However, since irradiated fuel assembly movement can occur in MODE 1, 2, 3, or 4, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. If moving irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operations. Therefore, in either case, inability to suspend movement of irradiated fuel assemblies would not be sufficient reason to require a reactor shutdown.

A.1, A.2.1, A.2.2, A.2.3, A.2.4, and A.2.5

By the allowance of the option to declare required features inoperable with the associated inverter(s) inoperable, appropriate restrictions will be implemented in accordance with the affected required features LCOs' Required Actions. In many instances, this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, operations involving positive reactivity additions, and declare the associated Low Temperature Overpressure Protection (LTOP) features inoperable). The Required Action to declare the associated LTOP features inoperable allows the operator to evaluate the current unit conditions and to determine which (if any) of the LTOP features have been affected by the loss of power. If the LTOP features have not been affected, then unnecessarily restrictive actions may be averted. The Required Action to suspend positive reactivity additions does not preclude actions to maintain or increase reactor vessel inventory, provided the required SDM is maintained. Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. These actions minimize the probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required inverters and to continue this action until restoration is accomplished in order to provide the necessary inverter power to the unit safety systems.

The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required inverters should be completed as quickly as possible in order to minimize the time the unit safety systems may be without power.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.8.1

This Surveillance verifies that the inverters are functioning properly with all required circuit breakers closed and required AC instrument buses energized. The verification of proper voltage output ensures that the required power is readily available for the instrumentation connected to the AC instrument buses. The 7 day Frequency takes into account the reliability of the instrument bus power sources and other indications available in the control room that alert the operator to malfunctions.

REFERENCES

1. UFSAR, Chapter 6.

2. UFSAR, Chapter 15.

BASES

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ATTACHMENT C

INFORMATION SUPPORTING A FINDING OF NO SIGNIFICANT HAZARDS CONSIDERATION

According to 10 CFR 50.92(c), "Issuance of amendment," a proposed amendment to an operating license involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not:

(1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or

(2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or

(3) Involve a significant reduction in a margin of safety.

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit," we are proposing changes to the Technical Specifications (TS) of Facility Operating License Nos. NPF-72, NPF-77, NPF-37 and NPF-66 for the Braidwood Station, Units 1 and 2 and the Byron Station, Units 1 and 2, respectively. The proposed changes are consistent with Technical Specifications Task Force (TSTF) Standard Technical Specification (TS) Change Traveler TSTF-360, Revision 1 and TSTF Standard TS Change Traveler TSTF-204, Revision 3. The proposed changes revise TS 3.8.4, "DC Sources – Operating," TS 3.8.5, "DC Sources – Shutdown," TS 3.8.6, "Battery Cell Parameters," and TS 3.8.8, "Inverters – Shutdown."

The proposed changes associated with TSTF-360, Revision 1, revise TS 3.8.4, TS 3.8.5, and TS 3.8.6 and include the following changes. The proposed changes add new Required Actions and extend the Completion Time for an inoperable battery charger, as well as provide alternate battery charger testing criteria for TS 3.8.4 and TS 3.8.5. The proposed changes also include the relocation to a licensee-controlled program of a number of Surveillance Requirements (SRs) in TS 3.8.4 that perform preventive maintenance on the safety-related batteries. It is proposed that TS Table 3.8.6-1, "Battery Cell Parameters Requirements," be relocated to a licensee-controlled program, and specific Required Actions associated with out-of-limits conditions for battery cell float voltage, float current, electrolyte level, and electrolyte temperature be added to TS 3.8.6. In addition, specific SRs are being proposed for verification of these parameters. In accordance with TSTF-360, Revision 1, a new administrative TS program is being proposed for the maintenance and monitoring of station batteries based on the recommendations of Institute of Electrical and Electronics Engineers (IEEE) Standard 450-1995, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications." All of the items proposed to be relocated will be contained within this new program.

The proposed changes associated with TSTF-204, Revision 3, revise TS 3.8.5 and TS 3.8.8 to require only one DC electrical power subsystem and two inverters, respectively, during shutdown conditions. This option to require only one DC electrical power subsystem and two inverters during shutdown conditions applies to plants having a pre-Improved TS (ITS) licensing basis for electrical power requirements during shutdown conditions that required only one DC electrical power subsystem and two inverters to be operable. The Braidwood and Byron Stations' pre-ITS licensing basis for electrical power requirements during shutdown conditions required only one DC electrical power subsystem and two inverters to be operable.

Information supporting the determination that the criteria set forth in 10 CFR 50.92 are met for this amendment request is indicated below.

1. **Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?**

   The proposed changes revise TS 3.8.4, "DC Sources – Operating," TS 3.8.5, "DC Sources – Shutdown," TS 3.8.6, "Battery Cell Parameters," and TS 3.8.8, "Inverters – Shutdown."

   TS 3.8.4, TS 3.8.5, and TS 3.8.6 have been revised to 1) add new Required Actions and extend the Completion Time for an inoperable battery charger, 2) provide alternate battery charger testing criteria for TS 3.8.4 and TS 3.8.5, 3) relocate to a licensee-controlled program a number of Surveillance Requirements (SRs) in TS 3.8.4 that perform preventive maintenance on the safety-related batteries, 4) relocate TS Table 3.8.6-1, "Battery Cell Parameters Requirements," to a licensee-controlled program, 5) add to TS 3.8.6 specific Required Actions associated with out-of-limits conditions for battery cell float voltage, float current, electrolyte level, and electrolyte temperature, and 6) add a new administrative TS program for the maintenance and monitoring of station batteries based on the recommendations of Institute of Electrical and Electronics Engineers (IEEE) Standard 450-1995, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications." In addition, TS 3.8.5 and TS 3.8.8 have been revised to require only one DC electrical power subsystem and two inverters, respectively, during shutdown conditions.

   The DC Sources, Battery Cell Parameters, and Inverters are not initiators of any accident sequence analyzed in the Byron/Braidwood Stations' Updated Final Safety Analysis Report (UFSAR). As such, the proposed changes do not involve a significant increase in the probability of an accident previously evaluated.

   The initial conditions of Design Basis Accident (DBA) and transient analyses in the Byron/Braidwood Stations' UFSAR assume Engineered Safety Feature (ESF) systems are operable. The AC and DC electrical power distribution systems are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that the fuel, Reactor Coolant System, and containment design limits are not exceeded. The operability of the AC and DC electrical power distribution systems in accordance with the proposed TS is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the plant. Therefore, the proposed changes do not involve a significant increase in the consequences of an accident previously evaluated.

2. **Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?**

   The proposed changes do not involve any physical alteration of the units. No new equipment is being introduced, and installed equipment is not being operated in a new or different manner. There are no setpoints at which protective or mitigative actions are initiated that are affected by the proposed changes. The operability of the AC and DC electrical power distribution systems in accordance with the proposed TS is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the plant. These proposed changes will not alter the manner in which equipment operation is initiated, nor will the function demands on credited equipment be changed. No alteration in the procedures, which ensure the unit remains within analyzed limits, is proposed, and no change is being made to procedures relied upon to respond to an off-normal event. As such, no new failure modes are being introduced. The proposed changes do not alter assumptions made in the safety analyses.

   Therefore, the proposed changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. **Does the proposed change involve a significant reduction in a margin of safety?**

   The proposed changes will not adversely affect operation of plant equipment. These changes will not result in a change to the setpoints at which protective actions are initiated. Sufficient DC capacity to support operation of mitigation equipment is ensured. The changes associated with the new administrative TS program will ensure that the station batteries are maintained in a highly reliable manner. The equipment fed by the AC and DC electrical power distribution systems will continue to provide adequate power to safety-related loads in accordance with analyses assumptions.

   Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

Therefore, based on the above evaluation, we have concluded that the proposed changes do not involve any significant hazards consideration.

ATTACHMENT D

INFORMATION SUPPORTING AN ENVIRONMENTAL ASSESSMENT

Exelon Generation Company, LLC (Exelon) has evaluated the proposed changes against the criteria for identification of licensing and regulatory actions requiring environmental assessment in accordance with 10 CFR 51.21, "Criteria for and identification of licensing and regulatory actions requiring environmental assessments." Exelon has determined that the proposed changes meet the criteria for a categorical exclusion set forth in 10 CFR 51.22(c)(9), "Criteria for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," and as such, has determined that no irreversible consequences exist in accordance with 10 CFR 50.92(b), "Issuance of amendment." This determination is based on the fact that this change is being proposed as an amendment to a license issued pursuant to 10 CFR 50, "Domestic Licensing of Production and Utilization Facilities," which changes a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, "Standards for Protection Against Radiation," or which changes an inspection or a surveillance requirement, and the amendment meets the following specific criteria.

(i) The amendment involves no significant hazards consideration.

As demonstrated in Attachment C, the proposed changes do not involve any significant hazards consideration.

(ii) There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

The proposed changes are consistent with Technical Specifications Task Force (TSTF) Standard Technical Specification (TS) Change Traveler TSTF-360, Revision 1 and TSTF Standard TS Change Traveler TSTF-204, Revision 3. The proposed changes revise TS 3.8.4, "DC Sources – Operating," TS 3.8.5, "DC Sources – Shutdown," TS 3.8.6, "Battery Cell Parameters," and TS 3.8.8, "Inverters – Shutdown." The proposed changes do not allow for an increase in the unit power level, do not increase the production, nor alter the flow path or method of disposal of radioactive waste or by-products. The proposed changes do not affect actual unit effluents. Therefore, the proposed changes do not change the types or increase the amounts of any effluents released offsite.

(iii) There is no significant increase in individual or cumulative occupational radiation exposure.

The proposed changes will not result in changes in the operation or configuration of the facility. There will be no change in the level of controls or methodology used for processing of radioactive effluents or handling of solid radioactive waste, nor will the proposal result in any change in the normal radiation levels within the plant. Therefore, there will be no increase in individual or cumulative occupational radiation exposure resulting from the proposed changes.